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Assessing Factors Influencing Trial and Adoption of a New Offering: A Case Study in Industrial Services Market

Master´s thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Technology in the Degree Programme in Industrial Engineering and Management.

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ABSTRACT OF THE MASTER'S THESIS

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Title: ASSESSING FACTORS INFLUENCING TRIAL AND ADOPTION OF A NEW OFFERING: A CASE STUDY IN INDUSTRIAL SERVICES MARKET

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Abstract:

Purpose – Commercializing and bringing new offerings into a market is a challenging, but in the long-term economically essential, task of firms. As various factors influence success in it, it is also a complex topic to research. Purpose of this research is to portray factors influencing trial and adoption of new offerings in a single comprehensive framework. In addition to providing empirical insights to the formed framework, empirical part of the research aims to deliver concrete recommendations on how to promote trial and adoption of the studied new offering further.

Design / Methodology / Approach – Research's approach is theory-led as an applicable framework is formed over the course of the literature review and its contents are thereafter verified and specified further in the empirical part of the research. Empirical part of the research is a single case study analyzing a specific new offering in industrial services market. Gathered data from 27 semi-structured interviews is primarily assessed with qualitative research methods in the study.

Key Findings – Research's key result is the above-mentioned framework and concrete recommendations on how to promote trial and adoption of the studied offering further. Key findings include further specifications of the research framework and assessments on positive and negative attributes of the studied offering.

Research limitations / implications – Formed framework is derived from a wide theoretical background, but its contents and logicality are tested in a single case study. This limitation of the research implies that future researches should confirm the legitimacy of framework's contents by testing its applicability to other offerings. Key managerial implication of the research is that various factors influence trial and adoption of new offerings both on an individual device- and system-level. Accordingly a comprehensive approach is required to manage positive and negative attributes of a new offering.

Originality / Value – Existing research is lacking a comprehensive framework of factors influencing trial and adoption of new offerings. In addition, scarce research has been conducted on factors influencing adoption of technological offerings which link to complex products and systems. Originality and value of this research is in providing insights to both of these topics.

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Tiivistelmä:

Tutkimuksen tarkoitus – Uusien tarjoomien kaupallistaminen on haastava, mutta pitkällä aikavälillä välttämätön, tehtävä yrityksille. Koska useat tekijät vaikuttavat siinä menestymiseen, se on myös haastava tutkimuskohde. Tämän tutkimuksen tavoitteena on kuvata uuden tarjooman kokeilemiseen ja omaksumiseen vaikuttavat tekijät yhdessä kokonaisvaltaisessa framework:issa. Framework:in rakenteen täydentämisen lisäksi tutkimuksen empiirinen osa pyrkii konkreettisten suositusten antamiseen siitä miten tutkitun tarjooman kokeilemistä ja omaksumista voidaan lisätä.

Tutkimusasetelma / Metodologia / Lähestymistapa – Tutkimuksen lähestymistapa on teoriavetoinen, sillä soveltuva framework muodostetaan kirjallisuuskatsauksen tuloksena ja empiirisessä osassa framework:in sisältö todennetaan ja sitä täydennetään soveltuvin osin. Tutkimuksen empiirinen osa on yksittäinen tapaustutkimus teollisille palvelumarkkinoille suunnatusta tarjoomasta. Kerättyä dataa 27:stä puoli-strukturoidusta haastattelusta analysoidaan pääsääntöisesti kvalitatiivisen tutkimuksen keinoin.

Päätutkimustulokset – Tutkimuksen päätuloksia ovat yllä mainittu framework sekä konkreettiset suositukset siitä miten tutkimun tarjooman kokeilemistä ja omaksumista voidaan lisätä. Tämän mukaisesti framework:iin tarvittavat muutokset ja lisäykset sekä analyysit sekä negatiivisista että positiivisista tarjoaaman ominaisuuksista ovat merkittäviä saavutettuja välitutkimustuloksia.

Tutkimuksen rajoitteet / implikaatiot – Muodostettu framework perustuu laajaan teoreettisen taustamateriaaliin, mutta sen sisältö ja logiikka todennetaan tässä tutkimuksessa vain yhdellä tapaustutkimuksella. Tämä tutkimuksen rajoite edellyttää, että tulevien tutkimusten tulisi todentaa frameworkin soveltuvuus myös muunlaisilla tarjoomilla. Tutkimuksen keskeinen implikaatio johtotehtävissä oleville henkilöille on, että useat yksikkö- ja systeemitasolla mahdollisesti eroavat tekijät vaikuttavat uuden tarjooman kokeilemiseen ja omaksumiseen. Tästä syystä vaaditaan kokonaisvaltaista lähestymistapaa tarjooman positiivisten ja negatiivisten tekijöiden hallitsemiksi.

Omaperäisyys / Lisäarvo – Olemassaolevassa tutkimuksessa ei ole tunnistettavissa kokonaisvaltaista framework:kia, joka kuvaisi uuden tarjooman kokeilemiseen ja omaksumiseen vaikuttavat tekijät yhdessä kokonaisuudessa. Lisäksi vain rajattua tutkimusta on tehty laajempiin systeemeihin linkittyvien teknisten tarjoomien kokeilemisesta ja omaksumisesta. Tämän tutkimuksen omaperäisyys ja lisäarvo on siinä, että se tuo lisätietoa näistä molemmista aihepiireistä.

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FOREWORD

Completing this thesis has been a challenging and rewarding process, which would not have been possible without several key people.

First of all, I would like to thank my instructor Ville Tiainen for his support and guidance even as this project extended beyond its planned execution. Without thought-provoking discussions we carried out, without positive feedback from him and without his hands-on approach, this thesis would not have molded into its current form.

I would like to thank the whole entrepreneurial team in the Case firm for guiding me into the world of industrial services and for teaching me the basics of selling. It has been a privilege to work with such motivated and skilled people on introducing a new offering into a market. I hope this study does justice to the great work you do.

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What I value of my studies the most are the fellow students of Industrial Engineering and Management that I have had the privilege to get to know of. With you I have had a tremendous time and great experiences both in school as well as out of school. I thank you all for the last years and I hope our adventures to continue in the future.

Last, and most importantly, I would like to thank my family – Outi, Kalle, Salla and Sakari – and my long-time partner, Julia, for being there for me even in challenging times. Your profound support during my studies and my whole life is a tremendous source of energy and motivation for me. Thank you for that.

Bad Homburg vor der Höhe, August, 2012

Ilari Lampela

1. INTRODUCTION

1.1. BACKGROUND OF THE RESEARCH

Commercializing and bringing new offerings into a market is challenging as existing research findings indicate success to be reached only in 50-60 % of the attempts (Chiesa and Frattini, 2011). As the previous figure includes only new offerings that were fully commercialized, real success rate is presumably even lower than that. While being difficult to carry out the commercialization of new offerings is of vital importance to firms as new products and services have been found to be the most significant characteristics explaining a firm's success (Tidd and Bessant, 2009, Chapter 1). This economically essential but challenging task of firms is the topic of this research. Aim of the research is to increase our understanding on commercializing offerings and to produce concrete recommendations on how to enable success of a specific offering, around which following research revolves.

Specific offering research revolves around is Case firm's individual condition-monitoring-solution, which has been recently introduced to industrial service markets. This offering is a mixture of product and service components and thus a new type of an offering, a new concept, in its respective market (Case firm's technical expert). Offering's product component is a fixed measurement unit that is installed to an applicable device and its service component is on-going monitoring and analysis of the obtained measurement data. As its key deliverable, the new concept is designed to identify breakdowns of rotating machines before they occur and incur additional cost. It provides continuous condition monitoring to a device and in case deviations in the measurement data are observed, customers are advised to react accordingly before any damages or production losses are incurred. Pure product and service offerings seeking to fulfill similar needs have been available for a considerable time-period, which is why the new offering is not a new-to-the-world offering, but an improved version of existing offerings. Initial success of the new concept has been two-fold. In locations where it has been implemented customer experiences have been encouraging as customers have been able to avoid unexpected production interruptions with the assistance of the new concept. Despite of its potential a low amount of initial customers have chosen to implement it.

Considering the probability for a success of a new offering to be the same as the probability of guessing on which side a coin is going to land, there is both theoretical and practical interest to increase our knowledge on which elements explain success of new offerings and how this information could be re-applied to increase success rates of the future offerings. To this end existing research has analyzed elements leading to success with different types of new offerings and with different types of new innovation development processes (one overview of the existing research efforts Tidd and Bessant, 2009, Chapter 9). Prevalent logic in the conducted research has been to identify factors and their underlying elements which have lead to success with certain offerings and assume that re-application of these same elements would improve success rates of subsequent offerings.

Thus far certain general factors contributing to success of new offerings have been identified in the existing research. As a wealth of possible market conditions exist and as various types of offerings may be introduced to these markets, several commercialization situations with certain specific factors contributing to success exist. These details are obtainable only with a detailed analysis of specific situations and of factors which are relevant in them. To date the existing research has analyzed in detail factors contributing to success in commercialization of pure product and pure service offerings both in industrial and consumer markets. Scarce findings on the other hand are available on offerings that are mixtures of product and service components. Similarly independent offerings without links to their surroundings systems

have been analyzed, while limited research has been carried out to analyze specific factors contributing to success, when an offering with links to the surrounding systems is brought to a market. In addition to lacking theoretical insights in certain areas, only limited attempts have been made to form a comprehensive research framework to represent different variables influencing this complex topic.

Considering that the existing research is lacking a clear research framework to represent various factors influencing this complex phenomenon; that existing research offers limited insights on specific factors contributing to success when an offering with links to the surrounding systems is brought to a market and that offering research revolves around links to its surrounding systems, this research's theoretical focus is evident. This research aims to contribute to the body of existing research by creating a comprehensive framework, which includes relevant factors influencing success of new offerings from various research areas and by studying specifics of bringing an offering to a market that links to wider systems surrounding it. This research's practical contribution is to provide concrete recommendations on how to enable or further promote success of the studied offering.

1.2. RESEARCH OBJECTIVES AND RESEARCH QUESTIONS

The research objectives of this research are threefold. As commercializing and bringing innovations to a market is a complex theme, the initial objective of this research is to review existing knowledge on it from several perspectives. The empirical part of the research links to technological innovations and industrial markets. Therefore emphasis will be placed on research findings that are relevant to them. Based on obtained findings, the aim is to form a framework, which summarizes our existing knowledge on the topic and enables a comprehensive assessment of factors that influence the trial and adoption of a new offering by different customer segments.

The second objective of the research is to finalize a comprehensive research framework on this multi-dimensional topic by confirming the legitimacy of the framework's contents with empirical evidence and by adding obtained additional insights to it. Testing of the research framework will be done by applying it to a real-life case example. In addition to confirming the existing research findings, additional factors and their underlying elements, which explain trial and adoption of new offerings, are aimed to be identified. Owing to focus on a technological new offering that has links to its surrounding systems, the objective is to elaborate our knowledge on factors that are relevant for this type of offerings.

The third objective of the research is to provide Case firm with an analysis on key factors influencing trial and adoption of its new offering and based on these analyses recommend concrete actions on how to enable and further promote success of its new offering. Recommendations will be based on both theoretical and empirical findings of the research. As case study will be based on a limited sample, Case firm has to conduct similar analyses to a larger population of customers to achieve definite results. Research thus aims to indicate important factors present in few specified customer segments and to lay out rationale for further analysis.

Based on the introduced research objectives following research questions are formulated for this research:

1. ***Which factors and underlying elements influence trial and adoption of a new offering?***
2. ***How is Case firm able to promote commercial success of its new offering?***

2. LITERATURE REVIEW

2.1. OBJECTIVES AND STRUCTURE OF THE LITERATURE REVIEW

In the literature review, existing research on commercializing and introducing innovations to a market is reviewed from multiple perspectives. The objective of the literature review is to examine major literature areas relating to the topic and to form a apt research framework, which provides a basis for the analysis of this multi-dimensional topic. As the empirical part of the research links to technological innovations and industrial markets, research findings relating to these areas are emphasized.

Literature review progresses from general findings on developing both product and service innovations to specific findings, on which factors contribute to a successful product, service and technically advanced innovation. Latter factors form the core content of the literature review as they link in a tangible manner to the studied case. Having reviewed key success factors in a detailed manner supplementary findings on achieving success in business-to-business markets and on conducting a successful commercialization of an innovation are discussed for further insights. To avoid overlaps latter parts of the literature review concentrate solely to additional findings on these themes and do not repeat previously identified findings from a different perspective. After a wealth of literature has been introduced and reviewed, a research framework is formed at the end of the literature review by identifying key factors influencing trial and adoption of an innovation and by categorizing these key factors in a mutually exclusive and conclusive manner. The aim is provide a framework on top of which further researchers may add their findings.

Each topic area is discussed in its own subchapter without a pre-defined structure. Notable of the way existing research is presented is that key findings on each sub-topic are presented after its conclusive review. These short summaries assist in handling a wealth of literature that is available on this topic.

2.2. INNOVATIONS AND THEIR DEVELOPMENT

Generating innovations is crucial for any firm as innovations have been found *to be the most important characteristic associated with firm success* in various studies (Tidd and Bessant, 2009, Chapter 1). As the term "innovation" refers to a variety of activities, several general definitions for it exist. This research follows Tidd and Bessant's view that an *innovation is a process of turning ideas into reality and capturing value from them*. Different types of innovations can be broadly divided into the following four categories:

1. *Product innovation: changes in the things (products / services) that an organization offers*
2. *Process innovation: changes in the ways in which they are created and delivered*
3. *Position innovation: changes in the context in which the products / services are introduced*
4. *Paradigm innovation: changes in the underlying mental models which frame what the organization does* (Tidd and Bessant, 2009, Chapter 1)

The focus of this research is on the first category of innovations: product innovations. Product innovations either aim to improve existing products or to bring new products to a market. Research has shown that firms being able to generate product innovations have with a higher probability a stronger market performance and are able to capture and retain market shares. In addition, with shorter product life cycles capability to replace products with

better variants has become increasingly important to firms (Tidd and Bessant, 2009, Chapter 1).

Product innovations are outcomes of new product or service development processes. These processes consist of various steps of selecting and developing an idea into a product innovation. Firms coordinate development processes in diverse manners, thus making it difficult to describe them with one universal model. Two dominant models describing them though exist: a Stage-Gate model and a Probe and Learn -process (Baker and Hart, 2007, Chapter 6).

The Stage-Gate model for new the product development (= NPD) consists of stages of activity, which are followed by review points, where a decision is made on whether to continue with the development of a product or not. Figure 1 illustrates one representation of a Stage-Gate model.

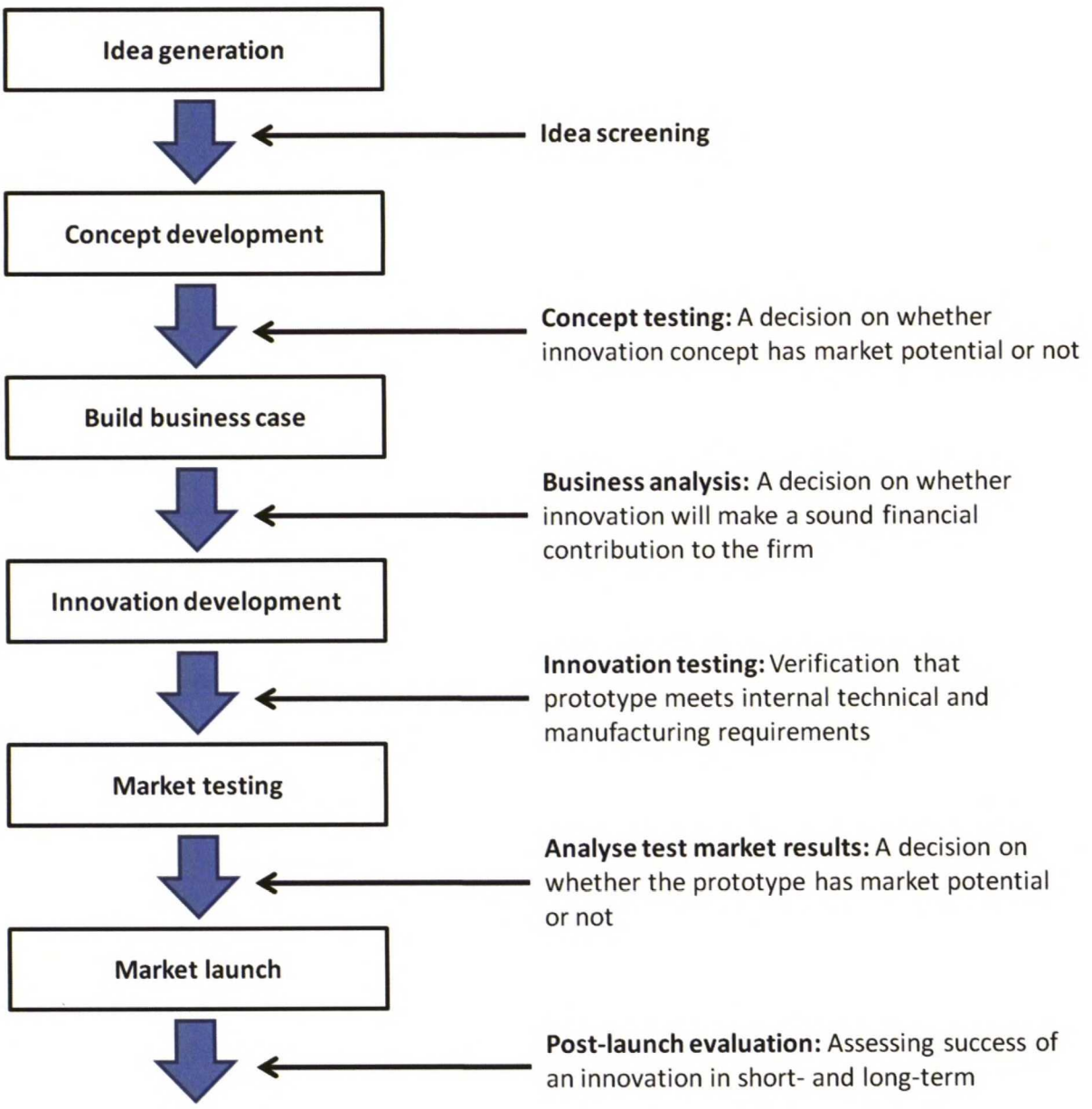


Figure 1. A representation of Stage-Gate model for new product development. Adapted from Baker and Hart (2007, Chapter 6).

In essence, the Stage-Gate model has three phases – idea -, product development - and launch phase –, which have been divided into respective key activities. In the first phase, the idea phase, the focus is on the market in order to justify the development of a product. In the second phase, the product development phase, the focus is on the technology and creating the product. In the third phase, launch phase, the attention is again on the market and on how it is prepared for the product (Kitcho, 1998, Introduction).

Each stage of activity in a Stage-Gate model is an entity, which is to be completed before moving on to the next. The Stage-Gate model provides thus a view on how activities are sequenced in a NPD process. Due to its focus on activities and their sequence, the Stage-Gate model has been criticized not to represent the actual processes taking place in firms. According to critics in practice there is no clear beginning, middle and end in a NPD process, because various activities take place parallel. In addition, actual NPD processes are stated to be iterative in nature, meaning that several iterations are made within and between stages before an acceptable solution is found (Baker and Hart, 2007, Chapter 6). Critics of the Stage-Gate model claim thus that a linear and exactly defined model is not suitable for representing NPD processes.

While the Stage-Gate model places emphasis on advancing from an activity to another and conducting various analyses in between, the logic in a Probe and Learn -process is to probe the market with a prototype, learn from the experience and improve the product (or service) accordingly. Testing and prototyping are thus core tenets of a Probe and Learn - process (Suikki and Haapasalo, 2006). As many activities in testing and prototyping are case specific, the Probe and Learn -process is presented in a generic manner in academic literature. A typical representation of a Probe and Learn -process is shown in Figure 2, where its three main steps are shown.

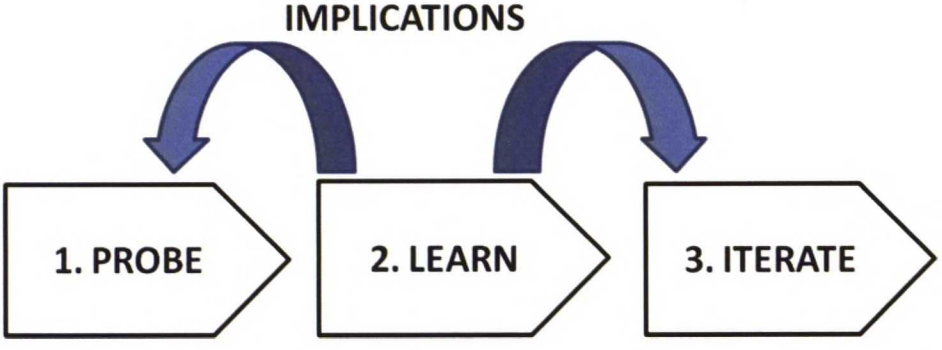


Figure 2. A representation of Probe and Learn -process. Adapted from Lynn et al. (1996).

In a Probe and Learn – process each iteration leads to the creation of a new and improved prototype, through which additional experiences are gathered from markets. This process is repeated until a viable product innovation has been reached through several incremental improvements (Lynn et al., 1996). As a result new products or services are not entirely planned in a Probe and Learn -process, but they are developed in a constant interaction with markets and customers.

Critics of the Probe and Learn -process point out that, in tangible terms, it offers a limited description of how NPD processes should be carried out. Despite of this researchers have found out that several firms successful at dealing with discontinuous innovations, which lead to entirely new families of products and businesses, conduct their new product development following the Probe and Learn -approach (Suikki and Haapasalo, 2006). Based on these findings, a theory has been proposed which states that concerning discontinuous

innovations there is not enough information to carry out thorough analyses, which is why probing and learning is the only applicable method for NPD (Lynn et al., 1996).

Presumably neither of these models describes exactly new product (or service) development processes in firms as they are mixtures of these two extremes (Suikki and Haapasalo, 2006). These models though portray that the NPD process may be analysis-driven as the Stage-Gate model is or experimental as the Probe and Learn -process (Lynn et al., 1996).

KEY FINDING:

- **One extreme of a new product development is an analysis-driven process, where stages of activity are followed by review points, where a decision is made on whether to continue with the development of an innovation or not. Other extreme is an experimental process, where market is probed with a prototype, lessons are learned from the experience and prototype is improved accordingly. It is presumable that neither of these models describes NPD processes in reality as they are mixtures of these two extremes.**

This subchapter has introduced innovations and innovation development processes that form a background for this research. In this setting certain factors contribute to generating commercially more successful innovations. These factors will be sought after from product, service and technology development literature in the following sub-chapters.

2.3. FACTORS INFLUENCING SUCCESS OF PRODUCT INNOVATIONS

Academic research on success factors of product innovations concentrates on three themes: firstly which success factors may be identified in successful NPD processes, secondly which factors influence adoption of a product innovation and thirdly which launch decisions lead to success when bringing an innovation to a market. As products, technologies and markets vary in each research, the obtained results differ in the relative importance of different factors. There are though recurring themes in all three research areas, which indicate consensus on the main success factors of product innovations (Tidd and Bessant, 2009, Chapter 9). These recurring themes are highlighted in the following paragraphs. One should note that the success of a product innovation is defined as financial success as it is an objective measure and thus equal to every case.

In the research on NPD processes a central assumption is that successful product innovations stem from exceptional development processes. Logic is that by identifying which factors are present in a NPD process leading to a successful product innovation, one should be able to replicate its features to increase the likelihood of future success in NPD processes. Table 1 shows the results of two exemplary researches on NPD success factors (Jin and Li, 2007 and Pattikawa et al., 2006) and of one literature review on recurring themes on this topic (Tidd and Bessant, 2009, Chapter 9).

Table 1. Results of two exemplary researches on NPD success factors and of one literature review on recurring themes on this topic

	NPD process success factors according to Jin and Li (2007)	NPD process success factors according to Pattikawa et al. (2006)	NPD process success factors according to a literature review of Tidd and Bessant (2009, Chapter 9)
1.	Product advantage	The degree of organizational interaction	Product advantage
2.	Market research proficiency	R&D and marketing interface	Market knowledge
3.	Concept development and evaluation	General product development proficiency	Clear product definition
4.	Market potential	Product advantage	Risk assessment
5.	Market information	Financial / business analysis	Project organization
6.	Technological synergy	Technical proficiency	Project resources
7.	Marketing synergy	Management skill	Proficiency of execution
8.	Market pre-testing	Marketing proficiency	Top management support
9.	Pre-development and planning	Market orientation	
10.	Market launch	Technology synergy	
11.	Proficiency of technical activities	Project manager competency	
12.	Strong financial and management support	Launch activities	

Of the unclear factors in Table 1 market potential refers to a product innovation having a large potential market, which is growing; market information refers to a firm understanding customer needs and competitors' present offerings; technological and marketing synergies refer to firm possessing adequate skills and resources in the respective fields without having to rely on other parties; market orientation refers to firm's ability to gather, share and use market information efficiently and launch activities refer to firm's ability to carry out promotion, distribution and sales efforts efficiently.

As the two exemplary researches indicate organizations identify numerous factors, which contribute to developing successful product innovations. These factors both link to pre-development, development and commercialization phases of a product innovation and this is why all parts of the NPD process require attention. Following common NPD success factors are featured in the two exemplary researches: *product advantage, technological synergy, proficiency of technical activities, marketing proficiency and launch activities* (Jin and Li, 2007 and Pattikawa et al., 2006). Following a similar approach of categorizing significant NPD success from an extensive quantity of studies factors into common categories Tidd and Bessant (2009, Chapter 9) analyzed existing consensus on this topic. According to their research following factors repeatedly explain success in NPD:

1 **Product advantage** – Product innovation with a high performance-to-cost ratio relative to its competitors and with superior perception in customers' views
2 **Market knowledge** – Proficient preliminary market, customer need and financial assessments
3 **Clear product definition** – An agreement on target markets, on pursued customer benefits and on product requirements before development begins
4 **Risk assessment** – Analysis of both technical and market-based sources of risks and design of appropriate contingency plans
5 **Project organization** – Product innovation is developed by a multidisciplinary and cross-functional team, which has a responsibility for the project over its lifetime

6 **Project resources** – Both financial, material and human resources have to be available for the new product development. Especially technological skills relating to a product innovation are important.
7 **Proficiency of execution** – NPD project tasks, for example technological activities and detailed market studies, are executed skillfully
8 **Top management support** – Management must have trust on the NPD project, but exercise adequate amounts of coordination and control

Taking into consideration the relative importance of the above-mentioned success factors Tidd and Bessant (2009, Chapter 9) state that product advantage is *the primary factor separating winners and losers*. Cooper (2000) analyzed financial and market success rates of various product innovations in his research and his findings confirm that product advantage is the most significant factor explaining NPD's success. In addition, Cooper's research indicates that success rate of product innovations with a low product advantage is significantly lower than of those which offer a high product advantage. The extent of relative product advantage is thus linked to the product's performance in the market. Further reinforcing previous views is Langerak et al.'s (2004) result that product advantage is a condition that a product innovation has to fulfill for it to succeed. Findings thus concur in that the product advantage is the most significant NPD success factor.

Creating a product with a significant advantage is a key success factor of a NPD process. However, this significant advantage is often not clear at the beginning of the development process. This is why product advantage may not be considered a fixed item in a NPD process, but a variable which is affected to an extent throughout the process. The creation of a significant product advantage has been found to be enhanced by the organization's market knowledge. It affects the product innovation's performance indirectly by increasing product advantage and through enabling appropriate launch tactics (Langerak et al., 2004 and Ottum and Moore, 1997). Similarly Cooper and Kleinschmidt (1995) obtained a result that understanding what benefit, superior performance and quality are to the customer and what customer value depends on are key to be able to deliver superior value with technical expertise to the customer. Market knowledge is thus closely linked to generating product advantage and through it to the success of a NPD process.

It is evident that a significant product advantage is a key success factor for a NPD process. Its creation in a NPD process is though significantly affected by market knowledge a firm is able to gather and to put into use. In addition, as success factors reviewed in Figure 3 indicate, the development of a successful product innovation requires the management of numerous product characteristics, such as product focus and advantage, as well as several organizational issues, such as project resources, execution and leadership. Concentrating only on one of these areas will unlikely lead to consistent successful results.

Figure 3. Consensus on new product development success factors (Tidd and Bessant, 2009, Chapter 9). Most significant success factor has been emphasized in the figure.

KEY FINDINGS:

- **The most significant success factor of a NPD process is a product innovation with a high product advantage relative to its competitors. In order for a firm to be able to develop products with a significant relative advantage it though has to be able to collect, share and put into use appropriate market knowledge.**

- **One has to manage both product characteristics and several organizational issues in the development of a successful product innovation. It is unlikely that consistent success is achieved by managing only one of these areas.**

In the research on which factors influence the adoption of a product innovation academic research has reached an agreement on the relevant factors, but has not been able to reach a consensus on their relative significance. Three categories of factors influence the adoption of an innovation:

1 *Characteristics of the innovation itself*
2 *Characteristics of individual or organizational adopters*
3 *Characteristics of the environment* (Tidd and Bessant, 2009, Chapter 8)

While developing a product innovation, a firm has a direct influence over the first category of factors influencing adoption. Following variables are included in this category:

1 **Relative advantage** – The price-to-performance ratio of an innovation compared to the existing solutions in the market. Performance is a multi-dimensional concept, which includes both economic and non-economic benefits like *social prestige, savings in time or effort and a decrease in discomfort* (Rogers, 2003). According to our current understanding the greater the perceived advantage, the faster an

innovation will be adopted (Tidd and Bessant, 2009, Chapter 8). As Cooper (1995) though states individual example markets have been found not to function in this manner as incremental enhancements and major upgrades have been found to have the fastest adoption rates. In regard of relative advantage one should identify primary and secondary attributes of an innovation. Primary attributes are constants irrespective of the adopter, for example price of a product innovation, while secondary attributes vary from adopter to adopter, for example added value from an innovation in a specific system (Tidd and Bessant, 2009, Chapter 8).

2 **Compatibility** – Whether an innovation fits (1) with existing skills, equipment, procedures and performance criteria and (2) with existing values and norms. First fit is critical and relatively easy to assess. Second fit, while being more difficult to assess, is at times even more important (Rogers, 2003).
3 **Complexity** – How difficult to understand or to use customers perceive an innovation. This perception reflects to the amount of new skills and training customer assumes to be necessary to acquire. Based on our current knowledge the easier an innovation is for potential users to understand the faster the rate of adoption (Rogers, 2003 and Tidd and Bessant, 2009, Chapter 8).
4 **Trialability** – The degree to which an innovation may be experimented before a purchase decision. In general, the more trialable an innovation is, the less uncertainty potential adopters experience and the more quickly it will be adopted (Tidd and Bessant, 2009, Chapter 8).
5 **Observability** – How visible benefits of an innovation are to others. An innovation with observable benefits will be more likely adopted than one with non-observable benefits (Rogers, 2003 and Tidd and Bessant, 2009, Chapter 8)

Of these different factors influencing the adoption of an innovation relative advantage and compatibility have been found to have *the greatest direct influence on trial and adoption* (Guiltinan, 1999). Customer perceptions are essential as relative advantage is measured against benefits of other products and compatibility is compared to the fit of previously used products. If an innovation is a new type of product and similar offerings are not offered in the market, its relative advantage and compatibility will be judged against offerings used to meet comparable needs (Guiltinan, 1999).

Research has shown that few innovations initially fit the user environment in which they are designed to. In case misalignment is significant innovation or targeted organizations, or both, have to change. According to case histories most successful implementations have been the ones, where mutual adaptation has occurred (Tidd and Bessant, 2009, Chapter 8). Notable is that compatibility links to knowledge of customer's organization as well. In case new knowledge is required or the value of customer's prior experience diminishes, compatibility is reduced (Guiltinan, 1999).

While complexity, trialability and observability have a lower impact on the adoption of an innovation, they are relevant factors nonetheless. One should note that a firm has limited influence over them, as they are often fixed characteristics that relate to the type of an innovation. Their effects may be mitigated, for example with appropriate marketing, but their source remains (Guiltinan, 1999).

Kim and Mauborgne (2005) have researched on factors that an innovation has to have for it to be successful. Their conclusions offer a different perspective on significant success factors of a product innovation. Their view is that most successful innovations fill uncontested market spaces, which they have labeled as "Blue Oceans", in a distinctive manner. This distinctive manner consists of the following aspects:

1. *Innovation provides exceptional buyer utility*
2. *Innovation is priced strategically*

3. *Target costs of the innovation are challenging to reach*
4. *Barriers to the adoption of the innovation have been minimized (*Kim and Mauborgne, 2005, Chapter 6)

According to them the first criterion for an innovation's success in a market is that it provides substantial benefits to customers. Providing exceptional buyer utility with an innovation appears self-evident, but according to the authors it is often forgotten especially when novel technology is part of the innovation.

An innovation has been priced strategically, when its pricing takes into account two important aspects. First, the set price should attract buyers in large enough numbers. This requires a comparison of one's solution not only to its direct competitors, but to a wider array of available solutions to which potential customers will compare it to. Second, the price should discourage imitation, because it is hard to prevent other firms from copying your innovation. According to the authors a second criterion for an innovation's success is thus that its price is not only competitive, but also discourages inevitable competition.

The third aspect of a successful innovation according to Kim and Mauborgne is that its target costs are challenging to reach. If strategic price was set accordingly, challenging target cost is a natural outcome. Because target costs are challenging to reach for any firm, authors state that process innovations are often necessary compliments to bringing successful innovations to a market.

The fourth criterion authors believe successful innovations have to fulfill is that their effects on the closest stakeholders of a company have been considered beforehand and possible interest conflicts have been minimized or gotten rid of altogether. This has to be done to reduce the barriers to adoption to minimum (Kim and Mauborgne, 2005, Chapter 6).

Even though Kim and Mauborgne (2005) concentrate on specific kinds of innovations – those, which aim for a high market share in a specific niche – success factors they state to be relevant are one view on what is required of a successful innovation. It coincides with other researcher's results on that a product innovation has to be able offer exceptional relative advantage. They also provide additional perspectives on pricing, costs and adoption barriers as factors determining the success of an innovation.

Alike Kim and Mauborgne (2005) other researchers have identified the significance of adoption barriers as well. One may identify adoption barriers relating to customers, to suppliers, to dealers, to competitors, to general public and to a firm itself. Of these different adoption barriers ones indisputably linking to a success of an innovation are customer-related adoption barriers. With other barriers research indicates that their significance increases when uncertainty over a future development is higher (Talke and Hultink, 2010).

As customer-related adoption barriers are an elusive concept no widely accepted definition of them exists. Tidd and Bessant list different customer-related adoption barriers into following categories:

- **Economic barriers** – for example both monetary and non-monetary benefits versus costs and costs of finding information
- **Behavioral barriers** – for example priorities of a person, willingness for change and rationality
- **Organizational barriers** – for example existing processes, prevailing culture and goals of an organization
- **Structural barriers** – for example existing infrastructure and sunk cost (Tidd and Bessant, 2009, Chapter 8)

As Tidd and Bessant's categories are presented on a general level, Sheth and Ram (1987, Chapter 3) analyze the most significant customer-related adoption barriers in their book. They identify both practical and psychological blocks that may prevent an organization from adopting an innovation. Sheth and Ram's categorization of customer-related adoption barriers is presented in Figure 4.

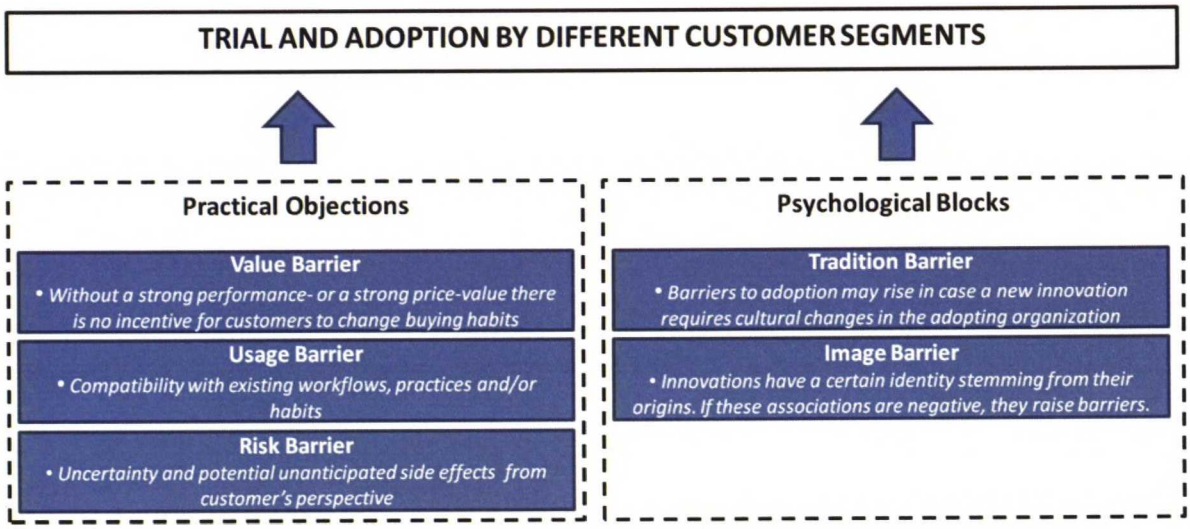


Figure 4. Customer-related adoption barriers according to Sheth and Ram (1987, Chapter 3)

The Value Barrier and the Usage Barrier in this classification relate closely to concepts of relative advantage and compatibility. In addition to them an innovation's adoption may be blocked by perceived risks relating to it, by cultural changes necessitated by it and by its negative image (Sheth and Ram, 1987, Chapter 3). As both reviewed classifications indicate, organizational barriers and customers' perceptions have an impact on adoption of an innovation. They have to be thus included in the analysis if one aims to understand reasons underlying the adoption of an innovation. As Sheth and Ram's classification incorporates factors presented by Tidd and Bessant and it is more comprehensible, it is used in this research to represents customer-related adoption barriers.

Customer-related adoption barriers may not be classified in the order of significance, because the presence of one of them is enough to prevent adoption of an innovation. This is why they have to be managed comprehensively. In addition, as these barriers arise from customer-side they vary with each customer and therefore are not constants properties of an innovation.

By combining findings on characteristics of a product innovation influencing its adoption and findings on customer-related adoption barriers, one is able to form a comprehensive view on factors influencing trial and adoption of a product innovation in a direct manner. Merged view on factors influencing the trial and adoption is presented in Figure 5. Due to the proximity of the concepts relative advantage and value barrier they are combined to a factor relative advantage while forming a merged view. The same applies for concepts of compatibility and usage barrier, which are combined to factor compatibility.

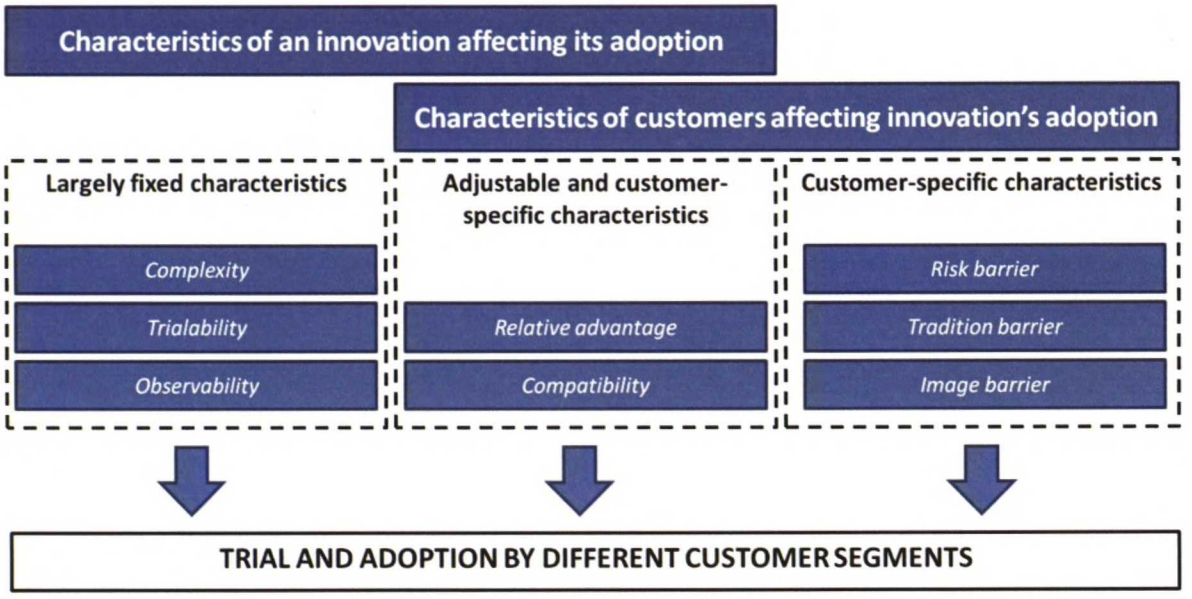


Figure 5. Characteristics of an innovation and of customers affecting trial and adoption (Sheth, 1987, Chapter 3, Rogers, 2003 and Tidd and Bessant, 2009, Chapter 8).

KEY FINDINGS:

- **Relative advantage, compatibility, complexity, trialability and observability are characteristics of an innovation, which affect its adoption. Two factors with greatest influence on trial and adoption are relative advantage and compatibility and this is why a firm should ensure product innovations' advantage in these dimensions.**
- **Regarding complexity, trialability and observability one has to accept that they are largely fixed characteristics of an innovation and their negative effects may only be mitigated.**
- **In addition to characteristics of an innovation one has to include organizational barriers and customers' perceptions of an innovation as factors influencing trial and adoption.**

Research on which launch decisions lead to success when a new product is introduced to a market mainly analyzes later stages of a NPD process. This phase of bringing a product innovation to a market is commonly referred to as *launch*. A launch may be defined as *the process of preparing the market for your product and putting all the vehicles and infrastructure in place to get it to market* (Kitcho, 1998, Part One). Numerous innovations have turned out to be commercial flops despite their technical superiority, because their launch activities were misaligned or poorly conducted (Chiesa and Frattini, 2011). This is why a skillfully carried out launch is a significant factor in achieving success with a product innovation. Adding to its importance is the fact that a in typical NPD process the launch is the part, into which a firm invests most money, time and resources to (Hutt and Speh, 1995, Chapter 11).

In academic research decisions defining launches have been divided into two groups: strategic launch decisions and tactical launch decisions (Chiu et al., 2006). In Figure 6 different decision categories and decision-making variables are presented.

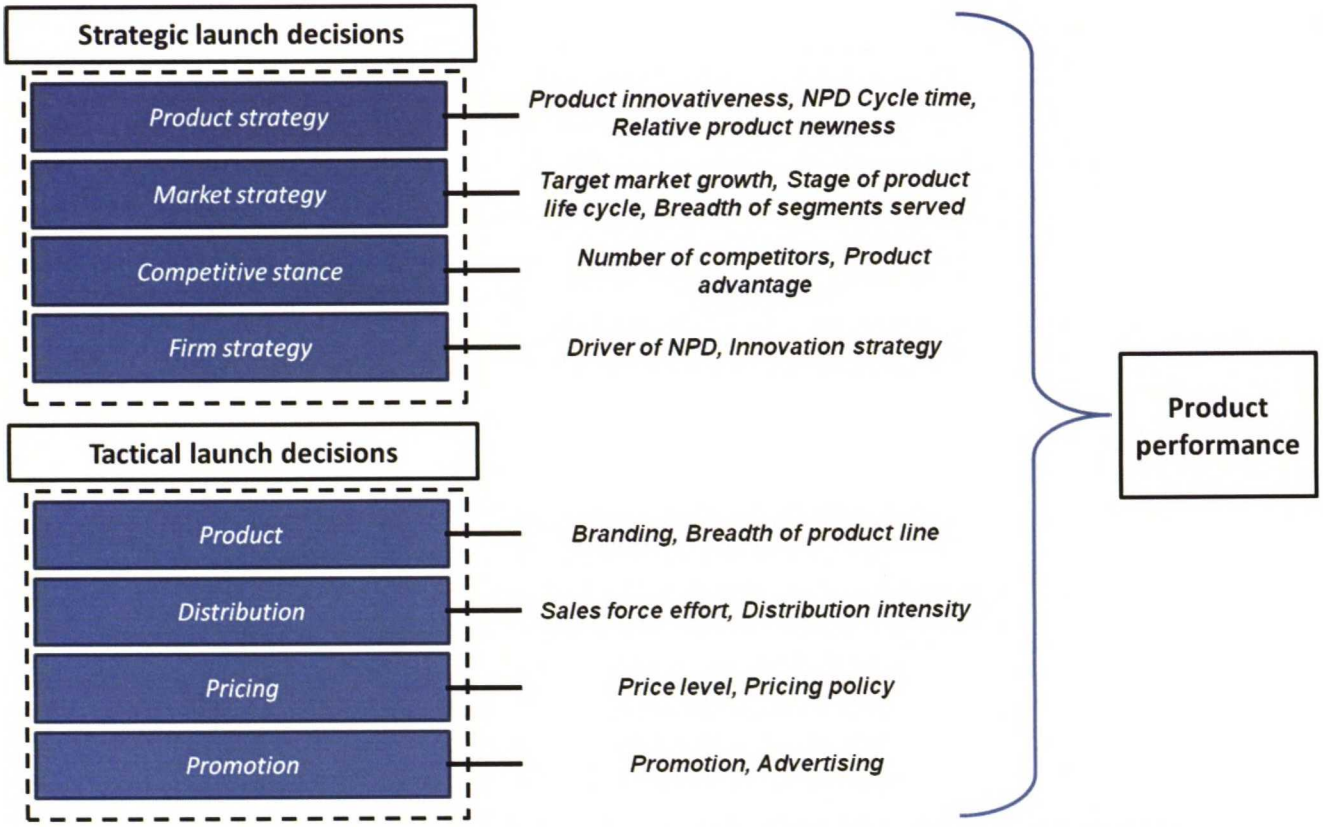


Figure 6. Strategic and tactical launch decisions, which define following launch activities (Hultink et al., 1997 and Chiu et al., 2006).

As Hultink et al. (1997) simplify launch decisions boil down to five key questions: *What to launch? Where to launch? When to launch? Why to launch?* and *How to launch?*. Strategic launch decisions define *what to launch, where to launch, when to launch,* and *why to launch.* These underlying decisions are made at an earlier stage of a NPD process. Due to the nature of these decisions they are expensive or difficult to alter at a later stage and many of them have an impact on future decisions. Tactical launch decisions in turn govern *how to launch* by defining different elements of the marketing mix (Hultink et al., 1997). These elements are pricing, distribution, used promotion and features of the product like branding and assortment (Kotler and Armstrong, 2008). Tactical launch decisions are modifiable and thus they may be changed even at a late stage of a NPD process (Hultink et al., 1997).

The main research finding regarding strategic and tactical launch decisions is that a firm maximizes the probability of success when it applies consistent sets of strategic and tactical launch decisions. Neither set of decisions may be defined in isolation, but has to be considered in regard of the other (Hultink et al., 1997). As surrounding launch environments vary in each market, no universal sets of decisions leading with higher probability to success may be defined (Guiltinan, 1999). Underlying considerations which assist in defining successful sets of launch decisions have been though identified.

Hutt and Speh (1995, Chapter 9) summarize the research results on market share development of new industrial products, which have been introduced to different market environments. The different market environments these products entered were either consciously chosen through strategic decision-making or made unconsciously. Despite of the process preceding their launch, these products followed certain strategic decisions on the type of market to be entered and on how to differentiate there. Findings Hutt and Speh (1995, Chapter 9) refer to indicate that taken strategic decisions reflect to success rates of new products. Original new products introducing never before used technologies to an industry, are more likely to have a higher first-year market share when competition is low,

when a product category is at the beginning of its life cycle and when the market growth rate is low. Reformulated products, which are modifications or extensions of existing technologies, on the other hand more likely gain a higher market-share in short-term when following characteristics are met: the satisfaction with the existing offerings is low, the marketing is conducted in an efficient manner, new product extends the market for the whole product group and the competition is low. In the longer-term both kinds of new product introductions succeed more likely when marketing is targeted with expertise, when it is conducted in an efficient manner and when the demand for product group is growing (Hutt and Speh, 1995, Chapter 9). As these findings on strategic launch decisions portray the amount of competition and potential for further growth indicate the success potential of a product innovation. In the long-run, a firm's proficiency in marketing turns though into a key success factor.

In their widely cited research Hultink et al. (1997) analyzed an extensive amount of industrial product launches and identified four sets of consistent strategic and tactical launch decisions, which had varying impacts on product performance. According to their results niche strategies are more successful than mass market strategies in industrial markets. Naturally the decision of whether to pursue a niche or a mass market strategy is not a simple choice of a firm. A product has to offer benefits and be compatible for a broad range of potential buyers for a mass market strategy to make sense (Guiltinan, 1999). As Hultink et al. (1997) indicate their result may be explainable with the nature of industrial markets, where needs of business customers are more individual.

In addition to identifying differences on relative success of opposite targeting strategies, Hultink et al. (1997) found sets of launch decisions which lead to higher relative performance within each targeting strategy. In industrial markets most successful firms applying niche targeting launch more innovative products, through exclusive channels with a skimming price strategy. Most successful firms targeting mass markets in turn launch equally innovative products, have higher sales force support for new product launches and use a penetration pricing strategy (Hultink et al., 1997). In industrial markets most successful niche and mass market strategies thus differ from each other extensively.

Guiltinan (1999) introduces a product newness lead perspective for analyzing appropriate launch decisions in each particular situation. According to Booz, Allen & Hamilton's typology, there are following classes of new products:

1. *New-to-the-world products*
2. *New (to the firm) product lines that enter established markets*
3. *Additions to existing lines*
4. *Improved/revised products re-entering established markets*
5. *Repositionings*
6. *Cost reductions* (Cooper, 1993, Chapter 1)

The first four categories of this typology represent the vast majority of new products. These four categories are differentiated by the degree of product newness, which in turn affects the kind of demand that is to be stimulated. With new-to-the-word products a firm must be able to convince customers to adopt a new solution. With improved/revised products re-entering established markets challenge is to convince customers to switch or migrate into using the new product. In classes of new products, where an established market is entered with a similar offering, namely in classes two and three, the goal is to capture a share of an existing market. Depending on the product newness a firm has to thus influence and promote different kinds of buying behavior patterns. According to Guiltinan this is why product newness is a key factor influencing how an effective launch plan is devised for a new product (Guiltinan, 1999). Figure 7 depicts linkages between product newness and buying behavior patterns that are attempted to be impacted.

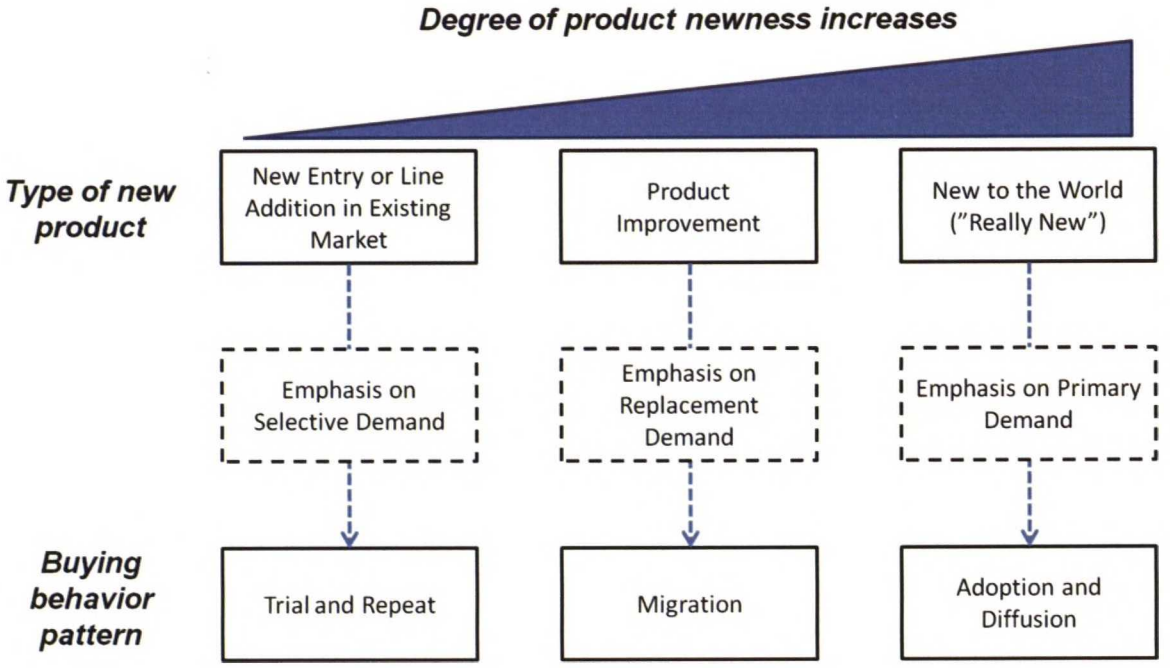


Figure 7. Main buying behaviour patterns aimed to be promoted with different degrees of product newness. Adapted from Guiltinan (1999).

Typically when the degree of product newness is low, the new product is unlikely to have major advantages over existing products. Its compatibility with customers' systems and processes tends to be though high. On the other hand, when the degree of product newness is high, the new product normally offers significant advantages, but its compatibility with existing usage patterns is low. New products with a moderate degree of newness do not have typical relative advantage and compatibility categories they fall into. Considering the buying behavior pattern aimed to be stimulated with moderate-newness products, there are two typical cases: in one a new product offers greater performance to a segment, where greater performance is valued and in other a new product is an upgrade that replaces an existing offering (Guiltinan, 1999). A notable research finding is that moderate-newness products underperform relative to low- and high-newness products. One explaining factor is that firms marketing activities with moderate-newness products have been found to be either misaligned or weaker (Kleinschmidt and Cooper, 1991).

By considering both views on the main buying behavior patterns and on typical relative advantage and compatibility attributes of new products with certain degrees of product newness Guiltinan (1999) constructed a framework for selecting an appropriate set of launch tactics. This framework is presented in Figure 8. The framework's message is that an assessment of relative advantage and compatibility of one's new product forms a basis for defining effective launch tactics. As relative advantage and compatibility are customer-specific properties separate launch plans may have to be defined to different customer-segments.

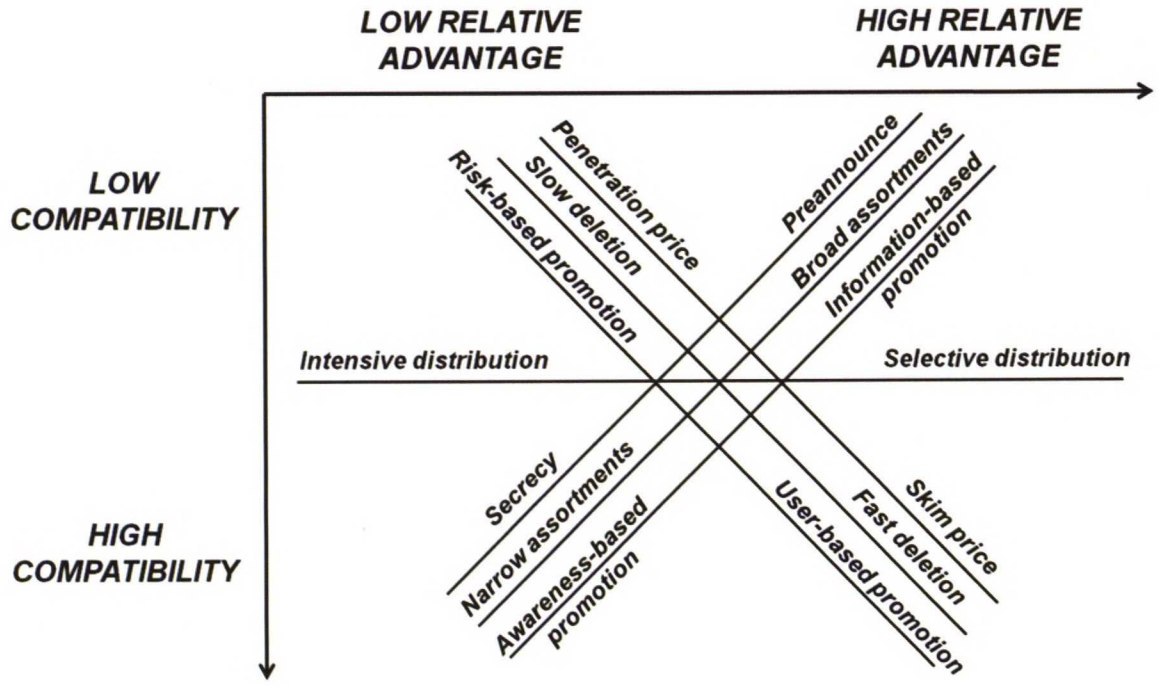


Figure 8. A framework for selecting a set of launch tactics (Guiltinan, 1999).

Of unclear concepts in the framework examples of risk-based promotion are *equipment allowances, leasing, money-back guarantees and warranties*, which reduce the customer's risk of acquiring a new product with a few incremental benefits; examples of user-based promotion are *beta tests and free samples*, which aim to prove that new product offers higher benefits than previous offerings and examples of information-based promotion are *shows, personal selling, demonstrations, Internet web sites, technical support, and publicity*, which aim to provide information that will shape customer's evaluations (Guiltinan, 1999).

New products with a low relative advantage and low compatibility will not easily be adopted by customers as they offer little incremental benefits and are somewhat incompatible with existing usage. According to the framework's suggestion the aim of effective launch tactics is in these situations to lower customer risk and adoption barriers to a minimum with promotional measures and penetration pricing. Penetration pricing is justifiable because without a strong relative advantage the likelihood that a large price-inelastic segment of customers exists is low. In case a new product is an upgrade to an existing one, slow deletion of the previous product ensures that a firm will not lose its existing customers satisfied with existing offering (Guiltinan, 1999).

Products having a high relative advantage and low compatibility are according to Guiltinan (1999) typically new-to-the-world products, where educating customers on potential benefits, which could be achieved with changes in their usage patterns, plays an important role. In addition, uncertainties customers perceive to relate to consumption benefits have to be handled with adequate information-based promotion (Chiesa and Frattini, 2011). A preannouncement of product launch may assist in preparing customers for a future change in their usage patterns. Furthermore, offering a new product in several varieties assists in reaching different customer segments.

New products having a low relative advantage and high compatibility are typically entries into existing markets. According to the framework's suggestion the aim of launch tactics is then

to promote Trial and Repeat -type of buying behavior. As awareness of a new product is the main determinant of trial, increasing it is a key component of launch tactics (Guiltinan, 1999).

A new product having high relative advantage and high compatibility offers benefits in attributes that are already recognized by customers. According to Guiltinan (1999) this type of new product is uncommon with mass market strategies as buyers have differences in their specific needs and usage patterns. The function of launch tactics is to present and to prove attainable benefits to individual customers. In addition, as offering adds a significant value to customer segments the skimming pricing strategy is a real option with this kind of new product.

As the framework indicates managers should make decisions on launch tactics based on an assessment of which measures will effectively promote the new product's adoption. Even though the framework offers exact recommendations its content is a proposition on effective launch tactics. Prevailing conditions surrounding a launch, for example competition, may necessitate launch tactics differing from the framework's suggestion (Guiltinan, 1999).

Different barriers that prevent customers from adopting an innovation provide the basis for Sheth and Ram's (1987) recommendations on effective launch measures. Even though their recommendations do not follow the academic classification of a launch plan, they offer views on how firms may deal with barriers that are preventing the adoption of an innovation.

According to Sheth and Ram (1987) the low compatibility of a new product may be mitigated with three main methods. One may integrate an innovation into a prior activity or product. In this approach low compatibility is compensated by other previously known attributes. An other approach is to develop a systems perspective, where an innovation has a central role. By adopting a new system or a new way of operating customers then naturally utilize the innovation. Another strategy, which has at times been successful, is to make an innovation mandatory through regulations. Naturally this strategy bears high risks (Sheth and Ram, 1987, Chapter 3). As these measures indicate low compatibility of an innovation may be circumvented at times.

If an innovation offers a low relative advantage, one has to alter it. According to Sheth and Ram (1987, Chapter 3) a firm may either increase the relative benefits of an innovation by positioning it in an application where it has a stronger price-performance value or a firm may reduce the innovation's costs and pass on the savings to the customers. A firm thus has limited options on how to increase the innovation's competitiveness in regard of this factor.

If risk barriers, which relate to uncertainty surrounding an innovation, cannot be overcome with normal information-based promotion measures, for example with customer testimonials, Sheth and Ram (1987, Chapter 3) propose systems packaging as a solution. In wider systems customers will not or cannot evaluate an innovation independently, thus diminishing risk barriers. Relating to risk barriers are image barriers, which according to the authors may be lowered either by promoting a certain kind of image or by linking the image of an innovation into an existing one. As images persist, a firm has to prepare for a longer-term commitment to create the image it wants for an innovation (Sheth and Ram, 1987, Chapter 3).

If an innovation necessitates cultural changes in adopting organizations, Sheth and Ram (1987, Chapter 3) state a firm to face difficult adoption barriers. According to the authors a cost-effective solution is to comply and adapt an innovation accordingly. If this is not possible, one has to resort to education and promoting change agents within the customers' organizations. This again requires long-term commitment from a firm and approach's results are uncertain.

These different measures proposed by Sheth and Ram (1987) are designed to improve an innovation's attributes in regard of a specific customer barrier. This is why they should be considered as additions to an overall launch plan in the situation that specific customer barriers are considered important to mitigate.

KEY FINDINGS:

- **A firm has to apply consistent sets of strategic and tactical launch decisions to maximize the probability of new product's success. As surrounding launch environments though vary in each market, no universal sets of decisions leading with higher probability to success may be defined.**
- **In industrial markets amount of competition and potential for further growth indicate success potential of a product innovation**
- **In industrial markets the most successful niche and mass market strategies differ from each other extensively.**
- **Product newness is one significant factor influencing design of an effective launch plan as it affects what kind of buying behavior patterns are aimed to be stimulated.**
- **In addition to an overall launch plan several specific measures may be taken in order to mitigate specific customer barriers that prevent adoption of an innovation.**

This subchapter has reviewed findings on success factors in a product innovation development process. The perspective progressed from execution of a NPD process to characteristics of an innovation and finally to launch decisions, which affect the adoption of an innovation. As reviewed literature indicates, this is a topic in which our existing knowledge is wide. As offerings of today are though increasingly combinations of products and various services, one has to include a service perspective into a thorough analysis. This is why service literature will be reviewed in the next sub-chapter.

2.4. FACTORS INFLUENCING THE SUCCESS OF SERVICE INNOVATIONS

Services have received extensive attention over recent years as their significance in Western economies has steadily increased. This increase is partly explainable with historically non-monetary transactions turning into monetary ones. A more significant effect has been with increased specialization, which has lead economic actors to outsource an increasing amount of their non-core activities, thus creating demand to various types of services (Normann, 2001). Despite an increase in research attention many research areas have not been able to reach an agreement on what significant differences exist between managing products and services. As Tidd and Bessant (2009, Chapter 9) state, managing innovations is one such a research area. No agreement exists on what of our knowledge of managing innovations in manufacturing is applicable to services and what of it is not. Nonetheless, progress on understanding success factors of service innovations has been made and these contributions will be reviewed in the following discussion.

Distinct differences of services to concrete products have been defined to be *intangibility*, *inseparability*, *perishability* and *heterogeneity*. Due to *intangibility* services cannot be physically observed or handled. Because of *inseparability* services are consumed as they are produced. Often this translates into high levels of interaction with customers as their

involvement is required in the service delivery process from the beginning on. As customers are an integral part of the process, services are often conducted physically close to customers. In addition, because of involved human factors service deliveries are never alike. This is why delivered services are *heterogenic* to an extent. Owing to *perishability* services may not be stored. This is why capacity planning is an important aspect in managing services (Hutt and Speh, 1995, Chapter 12 and Tidd and Bessant, 2009, Chapter 9). As these four distinct differences of services to concrete products portray, one faces some special challenges when managing services.

Introduced differences are clear when a sole product offering is compared to a sole service offering. Actual offerings though often comprise of both product and service elements. What determines a classification of an offering then are the perceptions of buyers on whether product or service elements dominate it (Hutt and Speh, 1995, Chapter 12). If one has to assess the significance of different elements of an offering without knowing customer's perceptions, Berry et al. (2006) propose assessing two dimensions. The first dimension is labor-intensity of an offering, which is measured with the ratio of labor costs to equipment costs. The second dimension is the degree of interaction with customers, which is assessed qualitatively. The more labor involved in an offering and the more interaction with customers, the more of a service it is.

A combination of a physical product and accompanying service elements has been labeled as an augmented offering. As technical differences between different physical products are small and often easily overcome, service elements of augmented offerings have gained in importance as a source of competitive advantage (Hutt and Speh, 1995, Chapter 12). Traditional manufacturing firms have been found out to construct successful augmented offerings and to increase their service business according to few business models. With embedded services -logic a manufacturing firm applies new digital technologies to integrate previously required services into a product. As customers are relieved of these tasks and of relating labor costs, they are willing to share some of the associated savings with the firm. With comprehensive services -logic a manufacturing firm extends from a role of a product supplier to a provider of variety of services. With integrated solutions – logic a manufacturing firm combines its own and external products and services into a new complete offering, which is aimed at solving a significant customer need (Wise and Baumgartner, 1999). As two later models indicate, augmented offerings may extend substantially beyond original physical product and at one point become perceived as service offerings.

Service innovations are thus developed to be parts of augmented offerings or to be individual offerings. Research on success factors of new service development (= NSD) has concentrated on the latter type of service offerings. Brentani has researched success factors of NSD in professional and business services, which are for example banking, IT-management, marketing, consulting and logistics services, where a physical product constitutes a non-existent or a limited part of an offering (Brentani, 1991, Brentani and Ragot, 1996 and Brentani, 2001). NSD success factors that have appeared in more than one his researches are shown in Figure 9.

Figure 9. New service development success factors that have been identified in more than one of Brentani's researches (Brentani, 1991, Brentani and Ragot, 1996 and Brentani, 2001). Most significant success factors have been emphasized in the figure.

Similarly to new product development a superior offering has been found to be a key success factor in NSD. On the contrary to new product development it is not the only key success factor. The ability to benefit from a firm's existing resources and proficiencies bears also a high significance in developing successful service innovations. This factor has its counterpart in the development of physical products, but there it is less significant and mainly links to technological synergy (Brentani, 1991, Brentani and Ragot, 1996 and Brentani, 2001). The key to success in NSD is thus to be able to develop a superior offering, which relies on the existing knowledge and resources of an organization. Moving far from a firm's current service line increases the risk of failure.

Other indicated success factors of NSD repeat in Brentani's researches, but do not stand out as highly significant ones. Client and marketing fit indicates that service innovations, which fit into customer base and marketing expertise of a firm have an increased likelihood of success. (Brentani and Ragot, 1996). Expertise in the specific service area refers to a firm being able to deploy expert front line personnel into the development and marketing of a service innovation (Brentani, 2001). Effective NSD culture within a firm is often reflected as a formal and planned launch program, but in reality it stands for that innovation is supported and senior managers are actively involved with frontline personnel and often with customers to create service innovations (Brentani and Ragot, 1996). Only this actual culture will lead to more successful service innovations. In addition, service innovations which are targeted at larger markets have a higher probability of turning out as successes (Brentani and Ragot, 1996).

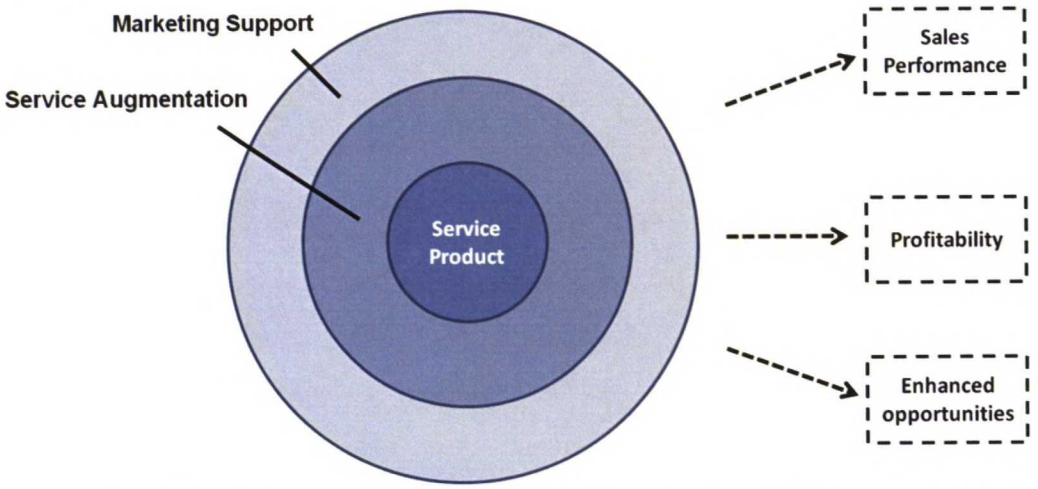
As success factors in new NPD relate to managing numerous product characteristics and several organizational issues, in NSD they relate more to building both on existing knowledge and on marketing and human resources that a firm possesses. This implies that successful service innovations are often incremental in nature as they have their foundations in the organization's existing resources and skills.

KEY FINDINGS

- **Superior service concept and firm's ability to leverage existing resources and proficiencies have been identified as two of the most significant success factors of NSD.**
- **As success factors in new product development relate to managing numerous product characteristics and several organizational issues, in NSD they relate to more to building both on existing knowledge and on marketing and human resources that a firm possesses.**

The development of new services requires less time and fewer resources than the development of new products. In addition, in services it is more difficult to protect one's innovation from imitation by competitors (Brentani, 2001). Because of these reasons competitors are able to duplicate core elements of a new service offering with relative ease. This results in firms having to build their new service concepts' success on other factors than sustainable advantage in the core component of a service (Storey and Easingwood, 1998).

Storey and Easingwood (1998) analyzed in their research different elements of service offerings and their respective impacts on measures of performance. As a part of their research they defined the concept of augmented service offering, which portrays different elements interwoven into a service concept. Storey and Easingwood's research framework, including the concept of augmented service offering, is presented in Figure 10.



Service Product: *Quality, Adaptability, Distinctiveness, Physical evidence and Perceived risk*
Service Augmentation: *Distribution, Reputation, Customer experience, Interactions with customers, Effective communication*
Marketing Support: *Staff training and skills, Effective operations, Launch strategy, Market knowledge, Investment in systems*

Figure 10. Elements of a service offering (Storey and Easingwood, 1998).

The key finding in Storey and Easingwood's (1998) research is that different parts of augmented service offering do not contribute similarly to certain performance measures. Improvements or changes in the service product itself have limited impacts on sales performance and profitability, but with them one is able to reposition the firm, open up new markets or develop platforms for further new products, all of which are labeled as enhanced opportunities in the framework. Improving service augmentation has significant effects on both profitability and sales, but non-existent effects on enhanced opportunities. Marketing support is the only part of an augmented service offering, which affects each studied performance measure more or less similarly (Storey and Easingwood, 1998).

Storey and Easingwood's (1998) findings question the way of thinking that improvements in the core component of a service lead to increased sales and profits. In a matter of a fact, if Storey and Easingwood's findings are applicable beyond financial services sector, a manager aiming at improved profitability and higher sales should concentrate on service augmentation and marketing as they are the two most significant entities affecting these variables (Storey and Easingwood, 1998).

While Storey and Easingwood (1998) approach performance as a result of different factors of augmented offering, other authors have sought to understand which elements of services represent value to a customer. If one would be able to identify all the relevant factors of value in services, one should be able to design offerings, which are more attractive to customers. Table 2 presents Whittaker et al.'s (2007) view on different components of value in business services.

Table 2. Components of value in business services (Whittaker et al., 2007) and their descriptions (Whittaker et al., 2007 and Sheth et al., 1991)

Component of value	Description
Price / Quality value	Customers' perceptions of the service they receive compared to payments and sacrifices they have to give.
Functional value	An offering's ability to fulfill its function. It may be derived from its characteristics, for example speed, reliability and durability.
Epistemic value	An offering's ability to add customer's knowledge or to introduce a new solution. In many services goal is to improve skill and knowledge base of a customer's organization
Social value	Represents concrete or perceived benefits customer acquires from association with one or more specific groups.
Image value	Represents concrete or perceived benefits customer acquires from association with a business partner that enjoys respectable market status.
Emotional value	Represents perceived feelings and affective states that an offering is able to arouse.

As value is a difficult concept to grasp and is perhaps contextual in nature, academic research has not reached an agreement on its components either in product or service offerings. Nonetheless, presented comprehensive view on customer value in services is sufficient to indicate that value is a wider concept than mere measurable attributes of an offering. *Price / Quality* and *Functional* components of value are two of the most concrete ones, while *Epistemic*, *Social*, *Image* and *Emotional* components are difficult to measure in tangible terms. Different components of value indicate that one should not simplistically analyze a new service concept in terms of measurable attributes, but to understand it as a combination of measurable and non-measurable attributes, all of which together contribute as added value to customers. Whittaker et al.'s (2007) views thus support Storey and Easingwood (1998) in that a service concept is a wider entity than its core component and these different elements may contribute to the added value of the whole.

KEY FINDINGS

- **Competitors are able to duplicate core elements of a new service offering with relative ease. This is why firms have to build their new service concept's success on other factors than sustainable advantage in the core component of a service.**

- **Customer value in services is a wider concept than mere measurable attributes of an offering. In addition to core benefit of an offering, it consists at least of benefits that customer receives from interaction with both the provider and peers.**

This subchapter has reviewed findings on success factors of service innovations. As literature review indicates a more limited amount of research is available on this topic. Its main content is that one should consider new service offerings as wider entities than their mere core component and develop them accordingly. In the next subchapter specific challenges facing technological innovations will be discussed in more detail.

2.5. FACTORS INFLUENCING THE SUCCESS OF TECHNOLOGICAL PRODUCT INNOVATIONS

Successful commercialization of technological innovations varies depending on the characteristics of the innovation and its markets. According to Tidd and Bessant (2009, Chapter 9) commercialization is mainly defined by two factors: the degree of novelty of a technology and whether it is aimed at satisfying existing or new customer needs. Figure 11 portrays four possible commercialization scenarios that form as combinations of these two factors. On one hand, when technology is of low novelty and it is aimed at satisfying existing customer needs, competition is mainly based on pricing, quality and additional services. On the other hand, when existing customer needs are aimed to be satisfied with novel technology, competition is based more on performance than on price or quality. In cases where existing technologies are applied to new markets, new applications of technologies are created. One is successful with these, if one is able to develop more effective solutions to specific market niches. The development of these occurs in most cases in a close co-operation with customers and potential users. When both technology and markets are of high novelty, technology being commercialized is initially lacking a clear application. A close co-operation with lead users will over time enable developers to identify new applications, where technology adds value (Tidd and Bessant, 2009, Chapter 9).

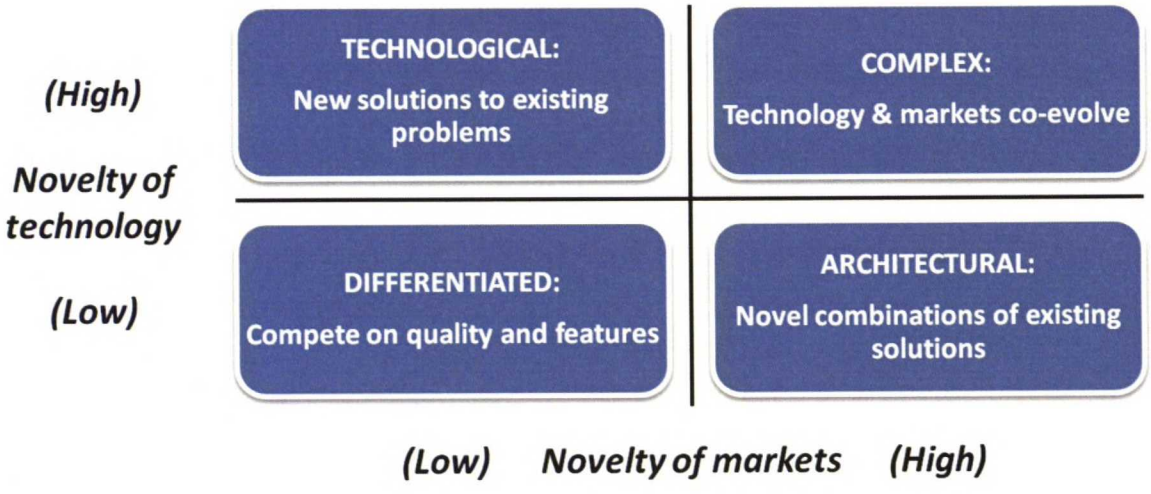


Figure 11. Influence of technology novelty and market novelty on commercialization. Adapted from Tidd and Bessant, 2009, Chapter 9.

According to Tidd and Bessant's view high-level technological innovations compete thus mainly on performance with existing solutions or by enabling new applications. In enabling new applications co-operation with potential users plays an important role. This perspective is a general one and does not illustrate the complexity of competition that high-level

technological innovations face. Research on complex products and systems, which dominantly are high-level technological products, offers more concrete insights on challenges of commercializing high-level technological product innovations.

KEY FINDING

- **In general high-level technological innovations compete either on performance with existing solutions or enable new applications of technologies**

Increasingly over recent years, research has been devoted to analyzing complex products and systems (= COPS). The interest to research these advanced technical offerings has risen as their economic significance has been understood and at the realization that our existing theories poorly explain industries linking to COPS. Economic significance of COPS is twofold as it consists of affiliated cash flows and of role of COPS in developing and introducing new technologies to markets. As the estimation of cash flows related to COPS is dependent on the applied classification scheme, an agreement has been reached merely stating that the development and production of COPS form a significant part of our economic system. Latter role of COPS in introducing new technologies to markets is more generally accepted (Davies and Hobday, 2005, Chapter 2).

Products that fall into the category of COPS are medium- to high-tech and they are combinations of several elements which together form a functional system. An array of several systems is not considered a COPS as definition is limited to individual systems (Davies and Hobday, 2005, Chapter 2). Figure 12 illustrates this category of products and systems.

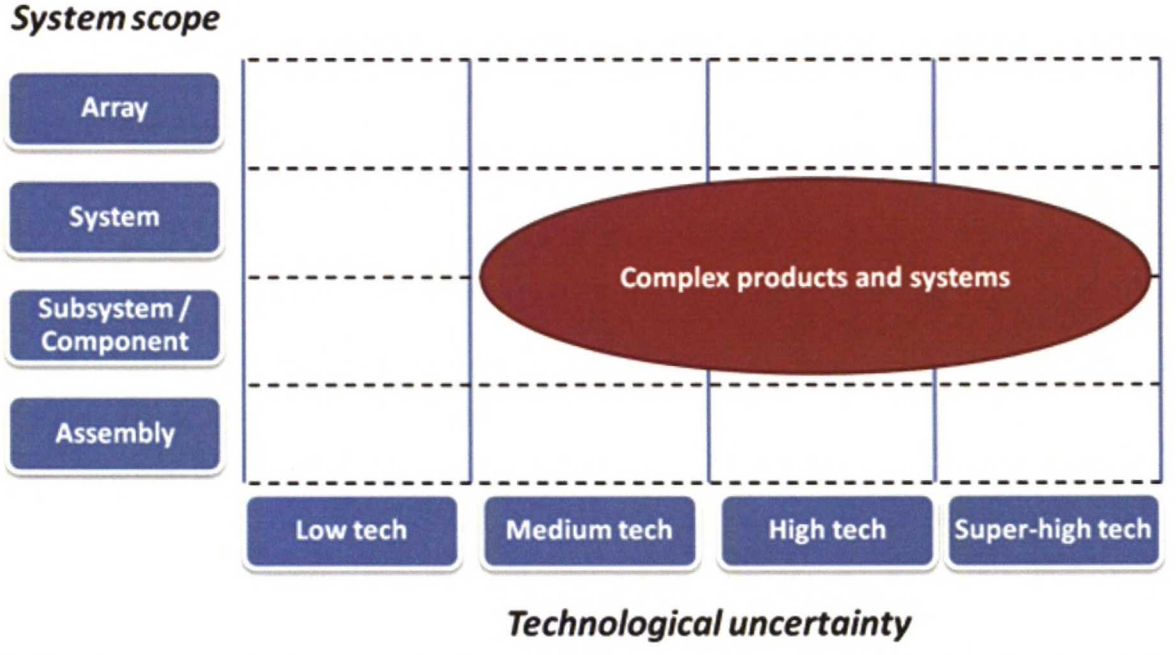


Figure 12. Category of products considered COPS in terms of system scope and technological complexity. Adapted from Davies and Hobday, 2005, Chapter 2.

As COPS have a certain scope and certain level of technological complexity they share few common characteristics. Bergek et al. (2008) summarize COPS as *products with high unit costs and degree of customization, several alternative architectures and deep systems*. High unit costs result from wide system scope and due to them adoption involves a long-term

commitment. This lengthens the buying process of COPS as customers are willing to invest considerable time and effort into it. Typically the customers' own technical knowledge is also higher when they are acquiring advanced technical solutions. Combined these two factors promote high degrees of customization as customers have time and capability to define systems, which fit their business needs as well as possible (Tidd and Bessant, 2009, Chapter 9).

As COPS consist of several interconnected customized elements there are multiple conceivable system architectures. When system architecture is chosen over several alternative ones, the development of COPS becomes path dependent in that changes in its architecture are seldom made although its individual elements are developed further. Over longer period, system architecture may change, but carrying out this change is difficult as changes in one part of the system often necessitate changes in other parts of the system as well (Bergek et al., 2008). Typically the complexity of COPS in terms of their architecture and their individual elements increases as higher levels of performance, capacity and reliability are strived for over time. This explains how deep systems of COPS develop (Davies and Hobday, 2005, Chapter 2).

While Bergek et al. (2008) identify general characteristics of COPS Davies and Hobday (2005, Chapter 2) have defined in concrete terms critical dimensions of COPS. These dimensions are listed and described in Table 3. According to Davies and Hobday (2005, Chapter 2) one may assess a product's complexity by considering the degree of each critical product dimension of it. Authors do not specify exactly how a product or a system is classified as COPS, but the higher each factor is (with the exception of product volume), the more characteristics of COPS a product or a system has.

Table 3. Critical product dimensions of complex products and systems (Davies and Hobday, 2005, Chapter 2)

Product dimension	Description
Unit costs / Financial scale of project	Financial investments required to acquire a product or a system
Product volume	Quantity of products and systems, which can be sold; contrary to other dimensions lower factor resembles COPS more
Degree of technological novelty	Degree of new technology that links to a product or a system
Extent of embedded software in the product	Degree of software that has been embedded into a product or a system
Quantity of subsystems and components	Of how many elements does a product or a system consist of
Degree of customization of components	Degree of customization in regard of individual components
Complexity and choice of system architectures	How interconnected a product or a system is and how complex constructing these links is
Quantity of alternative component design paths	In how many ways components of a product or a system may be designed
Feedback loops from later to earlier stages	Degree of alterations to system architecture and to design of specific components that may realize over development stages
Variety of distinct knowledge bases	Of how many areas knowledge is required to develop an efficient product or system
Variety of skills and engineering inputs	Of how many technological areas knowledge is required to produce a product or a system
Intensity of user involvement	How excessively users are involved in development and production of a product or a system
Uncertainty / Change in user requirements	Degree to which user requirements may change over development stages
Intensity of other supplier involvement	How excessively suppliers are involved in development and production of a product or a system
Intensity of regulatory involvement	Degree to which regulators affect development and production of a product or a system

Davies and Hobday's (2005, Chapter 2) critical product dimensions of COPS add to the general characteristics summarized by Bergek et al. (2008) that products resemble COPS more if they are produced in a low volume, contain a degree of novel technology and require a close co-operation with customers, suppliers and regulatory authorities. The key message authors aim to convey by listing critical product dimensions is that high degrees in several, but not all, of these are required to label a product or a system as COPS.

KEY FINDINGS

- **COPS may be summarized as products with high unit costs and degree of customization, several alternative architectures and deep systems. In addition,**

they contain medium- to high-tech, are often produced in low volume and are affected by co-operation with customers, suppliers and regulatory authorities.

- **A product or a system is considered COPS if it has a high degree in several, but not all, critical product dimensions listed in Table 3.**

Owing to characteristics of COPS innovations linking to them face specific challenges in their adoption. Innovations have traditionally been categorized as either radical or incremental. Radical innovations are defined as innovations, which contain new technologies that significantly change behavior and consumption patterns. Incremental innovations on the other hand are defined as innovations, which increase performance, but do not cause a behavior change or a change in consumption patterns (Chiesa and Frattini, 2011). As a result of research on COPS an additional category of innovations, architectural innovations, has been defined. Architectural innovations involve a change in product's architecture or system configuration without changes in its components (Henderson and Clark, 1990). Architectural innovations play a significant role with COPS as they lead to an emergence of a new dominant design according to which development will take place over several following product generations (Bergek et al., 2008).

Another perspective of categorizing innovations is to classify them as systemic or stand-alone innovations. Systemic innovations require significant adjustments in the system they are part of, while stand-alone innovations may be introduced without significant considerations of the surrounding system (Chiesa and Frattini, 2011). When one is dealing with systemic innovations successful commercialization of an innovation requires complementary investments in various different parts of the system. If these different parts are owned by separate entities, one has to obtain cooperation, which may be difficult if the parties have different perceptions of costs and benefits (Teece, 1984). This is why systemic innovations will more likely fail in the market because of lack support from surrounding network than stand-alone innovations (Chiesa and Frattini, 2011).

Different definitions of innovations indicate two challenges in adoption of innovations linking to COPS. First challenge is that their benefits may be undermined by costs that arise of required system changes to obtain them (Tidd and Bessant, 2009, Chapter 9). Second challenge is that one has to either concur with an innovation to existing system architecture or amass adequate support from adoption network to conduct necessary changes to system architecture (Chiesa and Frattini, 2011). Latter approach in essence requires promoting an architectural innovation of a system.

In their research on patterns of innovation in industries with complex technologies Kash and Rycoft (2000) identified three patterns that describe innovation development in them. In normal pattern established network of solution providers conducts incremental improvements to elements of existing system. In transition pattern established network of solution providers applies new technologies to a system thus changing its structure but preserving their role as part of the network providing it. In transformation pattern both technology and network of solution providers evolve resulting to a new system configuration and to a new network of solution providers. Including a technological innovation into COPS as a firm outside established network of solution providers thus requires promoting transformation pattern. As research findings show that development of COPS tends to follow a dominant design over several product generations (Bergek et al., 2008), sparking a transformation is a challenging task. According to Kash and Rycoft (2000) firms typically have been able to step in as a new network member simultaneously with major technological or regulatory changes (Kash and Rycoft, 2000).

KEY FINDINGS

- **Two challenges in adoption of innovations linking to COPS are that their benefits may be undermined by costs that arise of required system changes and that one has to either concur with innovation to existing system architecture or amass adequate support from adoption network to conduct required changes to system architecture.**

- **After a dominant design has been established changes in architecture of COPS are seldom made although its individual elements are developed further. This is why including a technological product innovation into COPS as a firm outside established network of solution providers is challenging. Typically firms have succeeded to step in with their offerings simultaneously with major technological or regulatory changes.**

System architecture and its inertia are predominantly tangible factors blocking adoption of a technological innovation as a part of COPS. In addition to tangible factors, research has shown that with high-level technological innovations some intangible factors are relevant as well. Mainly these intangible factors reflect in buying behaviors of customers and their effects may speed up or slow down adoption of a technological innovation (Tidd and Bessant, 2009, Chapter 9).

In their research Weiss and Heide (1993) tested several hypotheses on how buyers' perceptions of a technology and its suppliers affect their buying behavior. The results they obtained may be divided into four categories: how buyers' prior experiences with a product affect buying behavior; how buyers' perceptions of differences in technology affect buying behavior; how buyers' perceptions of the rate of change of the technology affect buying behavior and how buyers' relationships with their suppliers affect buying behavior. Figure 13 summarizes Weiss and Heide's (1993) results on effects of buyers' characteristics and perceptions on their buying behaviour.

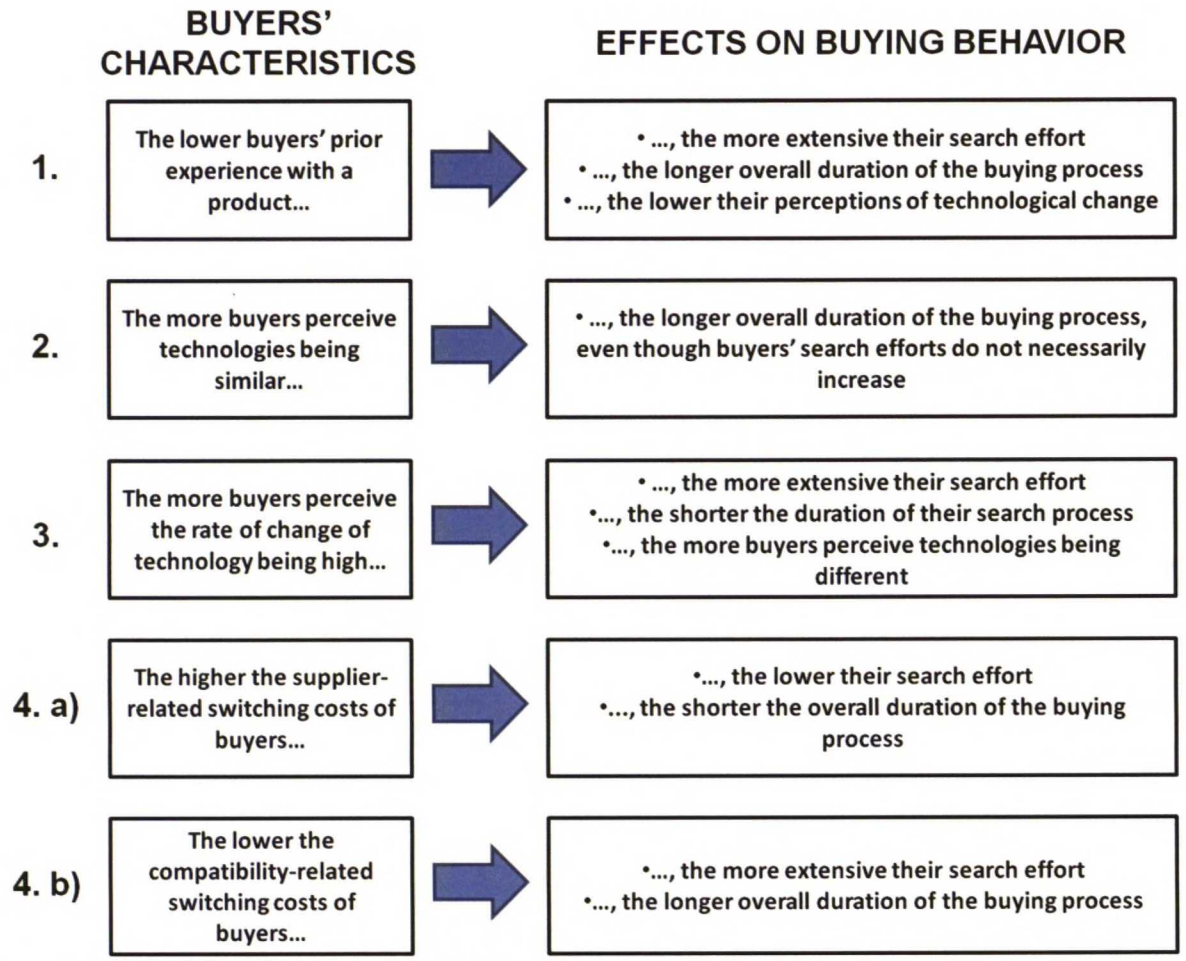


Figure 13. Effects of buyers' characteristics and perceptions on buying behaviour (Weiss and Heide, 1993 and Tidd and Bessant, 2009, Chapter 9)

Buyers' characteristics and perceptions thus mainly affect their search efforts and the overall duration of the buying processes. These in turn determine with what pace a technological innovation may be adopted. In cases where buyers do not have a prior experience with a similar product, where buyers perceive technologies to be similar and where compatibility-related switching costs of buyers are low, a technological innovation will probably be adopted with a slower pace. On the other hand, in cases where buyers perceive technologies to change rapidly, a technological innovation will likely be adopted with a faster pace (Weiss and Heide, 1993). Buyers though may choose to postpone their decision especially with non-critical functions, which is why rapid pace of technological change does not always result as a faster pace of adoption (Tidd and Bessant, 2009, Chapter 9).

Weiss and Heide's (1993) results on supplier- and compatibility related switching costs indicate that with COPS search efforts of buyers are lower as both identified switching costs are typically high with them. This is because of extensive customization, which necessitates additional learning from suppliers and which limits compatibility of alternative solutions (Davies and Hobday, 2005, Chapter 2). Implication of this is that buyers are not active in searching alternative solutions to their COPS, which further explains why certain established networks of providers are at times able to maintain practically status quo over several product generations.

Perceptions of buyers, which influence their behavior, are affected by buyers' underlying knowledge bases. Extent of customer's own knowledge thus influences the adoption of a technological innovation in several ways. In research linking to COPS technological

knowledge of a firm is defined in terms of its breadth and its depth. Breadth of technological capabilities indicates the number of technological fields maintained in-house. On the other hand, depth of technological capabilities indicates how extensively a firm participates in and understands each of these technological fields (Prencipe, 2000). Research on technology bases of suppliers and customers has not reached conclusive results on how different distributions of knowledge and skills between buyers and suppliers of COPS affect their relationships. Certain is though that technology bases of buyers and suppliers overlap to an extent (Prencipe, 2000). Buyers and suppliers thus possess similar knowledge on certain topics, while carrying out transactions relating to COPS.

With COPS another dimension of technological capabilities labeled as system integration capabilities has been defined. These capabilities refer to a firm's ability to integrate and link subsystems and components to form a functioning whole. System integration capabilities have been found to important when selling solutions linking to COPS as they enable a firm to integrate its solution to the whole (Bergek et al., 2008). Firm's system integration capabilities do not necessarily cover several areas of COPS as they may be limited to a specific area of it. Scope of systems integration a firm is able to carry out is a significant factor as it defines and limits the area of COPS to which a supplier may offer its solutions to. Typically firms choose either to have an extensive scope of systems integration within an industry or they provide similar limited part of the system to several industries (Davies and Hobday, 2005, Chapter 8). System integration capabilities are thus required from a provider of a technological innovation from that part of COPS innovation relates to. Lack of them may block an innovation's adoption altogether.

System integration capabilities of a firm in essence define scope of offerings a firm is able to offer. These offerings have to correspond to systems they are part of and to buyers' requirements as well. As a result of their research on buyers' requirements and attitudes Kaario et al. (2003) classify buyers of technological offerings into three groups, which are described in detail in Table 4. Groups differ from each other in the extent of their own technical knowledge and in their attitudes towards suppliers.

Table 4. Classification of buyers of technical offerings. Adapted from Kaario et al., 2003.

	Self-sufficient	Need for expertise	Need for more value
Knowledge of product and application	Customer has sufficient knowledge of product and application	Supplier has superior knowledge in product area	Supplier has superior knowledge of application, usage and financial impact
Price orientation	Focus on product cots	Focus on total cost	Focus on total cost in longer term and EVA
View of supply-side operation	Arms length attitude	Co-operative attitude in specific field of application	Open attitude – willing to utilize supplier's expertise in a broad sense
Trust in supplier	Trust in product	Trust in supplier	Trust in supplier as partner for several functions
Openness to share key business issues	Closed	Restricted to certain function	Willing to share in expectation of good return

Kaario et al.'s (2003) classification demonstrates that a supplier faces buyers with different levels of own technical knowledge. Buyers with high levels of own technical knowledge utilize supplier's technical knowledge less than buyers with lower levels of it. In addition, buyers have different general attitudes towards suppliers. These factors reflect to the scope

of offering buyers are seeking for. As these three buyer groups differ in terms of their requirements and how a transaction is carried out with them, a provider of a technological product should design appropriate offerings and sales processes to each one of them. Technological innovation's adoption is presumably promoted in the most effective way also with similar offering and sales process designs. Notable is that when one is dealing with a technological innovation, technical knowledge of its supplier is superior to buyers. This is why designing offerings to the two latter groups of buyers is more important than to the first group in the commercialization phase.

Ghosh et al. (2006) have researched on customization of COPS and as a result of their research they state that supplier should aim to a more leading role, when technological development is unpredictable, when several incompatible standards are in use and when technical capabilities of customers are of low-level. Reasoning of this is that it will provide the highest overall benefits to all included parties and enable a smooth execution. If this conclusion is a correct one, its implication is that not merely buyer's own technical knowledge defines the most applicable approach, but complexity of the surrounding environment as well. In more complex environments provider is better to define an offering on one's own initiative, while in less complex environments it may be customized in co-operation with customers. Ghosh et al. (2006)

KEY FINDINGS

- **Buyers' prior experience with a product, their perceptions and relevant switching costs mainly affect buyers search efforts and overall durations of the buying processes. These in turn determine with what pace a technological innovation may be adopted. Only in cases where buyers perceive technologies to change rapidly, a technological innovation will likely be adopted with a faster pace than normally.**

- **Technological offerings have to match both in terms of the underlying system and in terms of buyers' requirements. System integration capabilities of providers of technological products allow them to integrate their solutions as part of the underlying system, thus ensuring fit with it. Lack of these capabilities may prevent a provider from offering its solution altogether. Fit with buyers' requirements is a more complex topic with limited understanding. Main findings on it are that technology bases of buyers and suppliers overlap to an extent and a provider of a technological product should design appropriate offerings and sales processes to both technically advanced and less advanced buyer groups.**

This subchapter has provided an overview on peculiarities that one must consider with high-level technological products. As previous paragraphs indicate no clear factors influencing success of high-level technological product innovations have been defined, but several individual fields of research contribute to it. Key contribution of this part of the literature review is to show that technological offerings have to match both in terms of the underlying system and in terms of buyers' requirements. Accomplishing this is challenging, as a wide variety of knowledge and information is required. As high-level technological offerings are mainly offered in business-to-business markets, general success factors in these markets affect success of these offerings. This is why factors influencing success of an innovation in business-to-business markets will be reviewed in the next subchapter.

2.6. FACTORS INFLUENCING SUCCESS OF INNOVATIONS IN BUSINESS-TO-BUSINESS MARKETS

Preceding research review has introduced key findings on success factors in introducing new product, service or technological innovations to industrial markets. In addition to research on these specific topics, general research of business-to-business markets, which industrial markets are, offers insights on which factors determine success of an innovation in them. Adding up to previous themes are topics on how a purchase decision is made in business-to-business markets and how customer satisfaction is defined in them.

One substantial difference between consumer and business-to-business markets is that in business-to-business markets one has to influence several individuals before a purchase decision. Typically in a firm there are several levels of influencers, who have to concur with a purchase decision before it is made (Kitcho, 1998, Part One). One categorization of people involved in a buying process in business-to-business markets is following:

- Actual buyer – A person with the formal authority to carry out a purchasing decision
- Users of the product or service - Employees who will ultimately use or benefit from the product or service. They are typically, but not always, involved in specifying offerings to be purchased.
- Gatekeepers – People who control the flow of information into and out of an organization
- Influencers – Employees who provide technical support over the buying process (Tidd and Bessant, 2009, Chapter 9)

Participants to the buying process may have different preferences on offerings, for example actual buyer may emphasize value for money, while users value quality on top of other variables. This challenges providers to create marketing programs, which communicate effectively with all levels of buyer's organization (Kitcho, 1998, Part One). In addition, primary target to be influenced may not be the ultimate user of the product or service, which further complicates efficient marketing (Tidd and Bessant, 2009, Chapter 9).

In addition to personal roles and responsibilities, purchase decisions in organizations are affected by their political and legal environment, by their structure and by their routine of purchasing. The political and legal environment may specify a certain bidding process and it may affect how information concerning competing products is shared within an organization. This is especially relevant when dealing with governmental institutions. An organization's structure defines how centralized the decision making is. This is reflected in the buying process and in its length. How routine a purchase is affects the buying process as more routine purchases have a specific process in place, while irregular purchases are carried out with a more customized approach (Tidd and Bessant, 2009, Chapter 9).

Assumedly one advances adoption of an innovation by following similar principles of communicating effectively with all the levels of buyer's organization and by identifying primary targets to be influenced. How the political and legal environment, the structure and routine of the purchasing of an organization affect an innovation's adoption has to be assessed case by case. Presumably they have obstructive effects on adoption.

KEY FINDINGS

- **In business-to-business markets one typically has to influence several individuals before a purchase decision is made. These participants to the buying process may be divided into actual buyer, ultimate users, gatekeepers and influencers.**

- **Effective marketing programs communicate with all required participants to the buying process and concentrate on influencing the primary target, which may not be the ultimate user of the product or the service.**
- **Political and legal environment, structure and purchasing routine of an organization affect in addition how a specific buying decision is made.**

As in any market the customer satisfaction is also a complex and multi-dimensional theme in business-to-business markets. Because customers buy similar products for very different reasons, they weight different attributes of it differently. This in turn affects how each of them perceive satisfaction they gain from an offering (Tidd and Bessant, 2009, Chapter 9). Table 5 represents findings of the two researches, which analyzed factors that constitute customer satisfaction in industrial and business-to-business markets. Individual factors from both researches have been grouped to show similarities between these two researches.

Table 5. Overall customer satisfaction in industrial and business-to-business markets

Factors of overall customer satisfaction in industrial markets according to Homburg and Rudolph (2001)	Factors of overall customer satisfaction in business-to-business markets according to Zolkiewski et al. (2007)
1. Satisfaction with products	1. Product performance 2. Meeting requirements 3. Technical advantage
2. Satisfaction with technical services	4. Installation 5. Minimum disruption 6. Training 7. After sales service
3. Satisfaction with order handling 4. Satisfaction with complaint handling 5. Satisfaction with salespeople	8. Responsiveness 9. Complaint handling 10. Communication
6. Satisfaction with interaction with internal staff	11. Performance of employees 12. Experience 13. Good safety and environmental record
7. Satisfaction with product-related information	14. Product related information 15. Clarity of written material

As Table 5 indicates the customer satisfaction is generated not only by offering a superior product but also by having a range of technical services, which augment the product. Furthermore, by having a well-functioning sales process, which if necessary is able to handle complaints, as well as by providing professional interactions with a firm's staff and by being able to communicate information transparently about a firm's products (Homburg and Rudolph, 2001 and Zolkiewski et al., 2007). These findings implicate that in industrial and business-to-business markets, the mere analysis of the core offering will only provide a partial image of the achievable level of customer satisfaction.

Researches of Homburg and Rudolph (2001) and of Zolkiewski et al. (2007) identify factors, which customers experience as significant for their satisfaction. Authors do not attempt to assess a relative significance of different factors nor do they indicate how a firm is able to improve on these factors in concrete. Kitcho (1998, Part One) and Davidow (1986, Chapter 4) provide insights to the latter point in their partly academic publications. According to them

a firm is able to provide a superior customer satisfaction only by limiting the amount of customer segments it serves.

One representation of industrial markets is to divide them into horizontal and vertical markets. Horizontal markets consist of similar applications in various types of industries, while specific industries represent vertical markets. If a firm targets horizontal markets it typically concentrates on a certain recurring application and in doing so it will acquire a general-level knowledge of various industries. In case a firm targets certain vertical markets it is able to build up a specific knowledge of them and understand the customers' needs that are peculiar for the targeted industries. Typically, a process of acquiring this specific knowledge from a vertical market is expensive and time-consuming (Kitcho, 1998, Part One). According to Kitcho (1998, Part One) and Davidow's (1986, Chapter 4) views, reaching high-levels of customer satisfaction requires a firm to acquire this type of knowledge from every vertical market it serves, which makes wide horizontal targeting unfeasible. According to the authors, the focus is thus a necessity for a firm trying feasibly deliver a high-level customer satisfaction to certain customer segments. In addition to focusing on certain industries, a firm may have to consider restricting one's operations geographically in order to be able to feasibly deliver high-level customer satisfaction (Kitcho, 1998, Part One)

From the perspective of customer satisfaction an innovation's adoption may be promoted by comprehensively developing different factors of customer satisfaction relating to it and by considering an appropriate industry and geographic targeting. Especially, when bringing an innovation to a market, its adoption could be enhanced by introducing it to a vertical market, where a firm has already acquired specific knowledge required to achieve high-levels of customer satisfaction.

KEY FINDINGS

- **Customer satisfaction is a multi-dimensional theme in business-to-business markets as it consists in addition to a superior core offering of being able to offer a range of technical services, which augment the product; of having a well-functioning sales process; of professional interactions with firm's staff and of being able to provide adequate information of one's products.**

- **Some authors state that high-level customer satisfaction is economically achievable by narrowing down industries and geographical scope that one serves.**

This subchapter provided an overview on how a purchase decision is made in business-to-business markets and how customer satisfaction is defined in them. They add to the previous themes by indicating that in business-to-business markets several individuals may have to be influenced before a purchase decision is made and that customer satisfaction in business-to-business markets is a multi-dimensional theme, in which the core offering is only a part of the whole. Similarly to general research of business-to-business markets general research on commercialization of innovations may indicate additional factors and patterns that are important determinants of an innovation's success. This is why this research area will be reviewed in the next subchapter.

2.7. SUCCESS FACTORS IN THE COMMERCIALIZATION OF INNOVATIONS

The general research on commercialization is vast as it is a central theme in business literature. Typically academic or non-academic literature relating to this topic presents frameworks, which aid in assessing whether a business opportunity is a viable and whether

it has commercialization potential. Individual business opportunities may be based on innovations, but this is not necessarily the case. One categorization method of different business opportunities is to divide them into ones that exploit market imperfections, ones that stem from technological innovations, and ones that create value by reconfiguring value creation systems (Normann, 2001). As a thorough review of different frameworks for assessing the potential of a business opportunity is not meaningful in the scope of this research, key insights on this theme will be reviewed through few frameworks. In addition, diffusion models will be shortly discussed to understand how successfully commercialized innovations spread in a market.

After researching various entrepreneurial ventures, Mullins (2006) came to the conclusion that one should analyze the market, the industry and the entrepreneurial team domains to be able to assess the individual business opportunity's attractiveness. The key to success in a market domain is to be able to define an attractive target segment, where one is able to create additional benefits to its customers. In the analysis of the industry domain one should obtain an understanding of how sustainable one's advantage is. Concepts without any protection from competition will undoubtedly be copied, which reduces their attractiveness. The assessment of the third area, team domain, indicates whether one's organization or team has adequate knowledge, resources and connections to pursue defined opportunity. Attractive business opportunities are in Mullins's (2006) view those, whose assessments are positive in all of the three domains. According to the author, the most defining factor influencing business opportunity's attractiveness is its quality in market domain. For a potential to exist one must thus find an attractive target segment, where one is able to contribute added value.

As Mullins (2006) has researched business opportunities in general, Jolly (1997, Chapter 8) has concentrated on business opportunities that are based on technological innovations in his research. According to his views, one has a higher probability of achieving success in their commercialization by following certain measures. The main measures proposed by Jolly (1997, Chapter 8) are summarized in Figure 14.

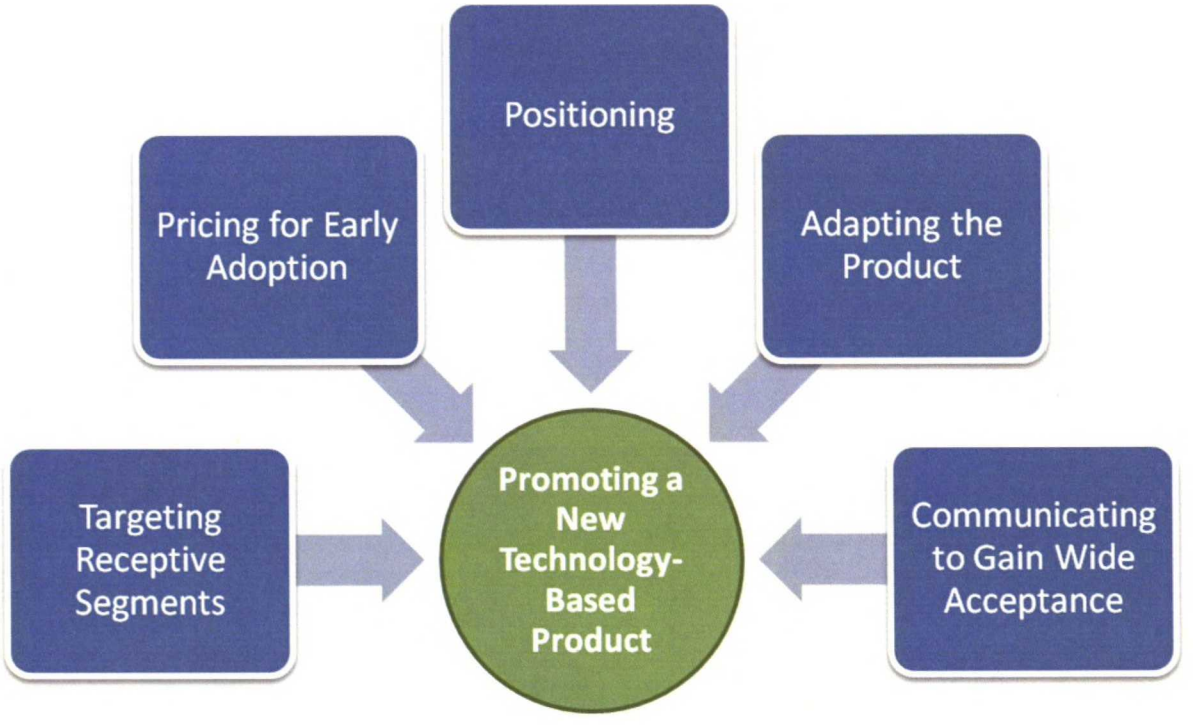


Figure 14. Main measures in a strategy to promote commercialization of new technologies. Adapted from Jolly, 1997, Chapter 8.

Of the main promotional measures "Targeting Receptive Segments" is self-evident as concentrating initial marketing efforts to receptive buyers leads with highest probability to results. Being able to do this in concrete is challenging as a firm may not be aware of the market segment, in which an innovation adds most value. In addition, targeting may require flexibility from a firm as it may have to co-operate with new customers to be able to bring a technological innovation to the market. Even though these initial customers are of high significance when bringing a technological innovation to a market, their commercial potential is often limited. This is why a firm should develop its offering in terms of a wider audience amidst serving these initial customers. The commercial success of a technological innovation typically depends on whether it is applicable beyond its initial customer segment (Jolly, 1997, Chapter 8).

According to Jolly (1997, Chapter 8), a successful commercialization of a technological innovations is linked to competitive pricing from the beginning on. In essence this translates to subsidizing experimental users to an extent and generating positive cash flows only thereafter. In regard of positioning, the author has found that technological innovations that emphasize one dominant attribute succeed more often. As technological innovations may be superior in many areas to previous technologies, the marketing expertise of a firm is required to define, which dominant attribute is to be emphasized. As with customer segments the positioning of a technological innovation has to develop over time as further customer segments are targeted (Jolly, 1997, Chapter 8).

Format technological innovation is offered in is also of significance in determining whether it is adopted or not. Technological innovations that follow existing patterns of use have a higher probability of success. This is why one should aim to offer technological innovation with an existing pattern of use. If the nature of technological innovation prevents this approach, one achieves success more likely by making the technological innovation invisible to customers. Besides adapting technological innovation to the customers' buying habits, one has to communicate it transparently to the customers to increase its probability of becoming a commercial success. According to the author, this is achievable through leveraging the opinion leaders and by exploiting existing communication networks (Jolly, 1997, Chapter 8). The marketing expertise of a firm naturally assists in conducting both of these marketing communication approaches.

When considering the implication of Mullins (2006) and Jolly's (1997, Chapter 8) views on bringing innovations to a market, one notes that both authors emphasize the importance of finding a target segment, where an innovation is able to contribute added value. Identifying and confirming the existence of a highly potential customer segment is thus a key indicator of a an innovation's potential. Mullins's (2006) also emphasizes the importance of having or being able to develop sustainable advantage, which ensures competitiveness in the long-term. The means of achieving this should thus be scrutinized, when assessing an innovation's potential. Many of Jolly's (1997, Chapter 8) promotional measures emphasize or link to marketing expertise of a firm, which further reinforces the view of it being one significant success factor when bringing an innovation to a market.

KEY FINDINGS

- **The key success factor in the commercialization of an innovation is to be able to identify an attractive target segment, where one is able to create additional benefits to its customers.**

- **Commercial potential of initial customers is typically limited, which is why the provider of an innovation has to develop its offering to a wider audience to achieve real commercial success.**

- **The sustainability of the initial advantage has to be assessed, as lack of it decreases the attractiveness of a business opportunity greatly.**

As successful commercialization requires a provider of an innovation to be able to widen its customer base from initial customers to a wider audience it has to in essence promote the diffusion of an innovation in a market. According to Rogers (2003), diffusion is a *process by which an innovation is communicated through certain channels over time among members of a social system*. Certain factors influence this process and because of that they also affect the success of a commercialization. This is why they have to be considered in more detail.

A classical generalization of markets is to consider them to consist of a handful different customer segments in terms of their pace of adopting an innovation (Kotler and Armstrong, 2008). This generalization is presented in Figure 15.

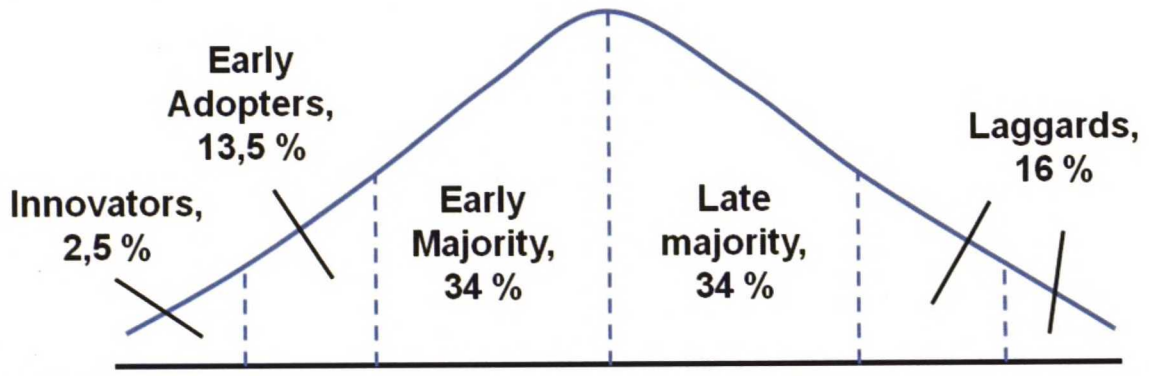


Figure 15. Adopter groups in terms of relative time of adoption of an innovation. Adapted from Kotler and Armstrong, 2008.

If market participants adopt an innovation according to this general view, the percentage of adopters will form a traditional S-Curve if it is drawn over time. Research has shown several markets to follow this pattern of diffusion (Tidd and Bessant, 2009, Chapter 8). In addition to forming a general view on adoption behaviors of different market participants, researchers have proposed various models to explain the process of diffusion in concrete. Epidemic and probit models are based on the assumption that market participants make individual rational decisions regarding the adoption. In environments where market participants feel uncertain of adoption decisions and where imitation is a significant phenomenon, these models fail to describe diffusion patterns in a market. Sociological models assume that a market consists of certain amount of rational participants that carry out adoption decisions individually and of a certain amount of participants that rely on experiences of previous adopters. Early adopters in these models may be affected with marketing communication, while the rest of the population follows strongly opinions of these early adopters. Typically these latter models have a stronger explanatory power, though they are more complex to implement in practice (Chiesa and Frattini, 2011).

Once an innovation reaches a certain spread in a market, described diffusion patterns become observable. What is not described in these patterns is the pre-diffusion phase of an innovation, which ends when a sufficient amount of market participants have adopted it. Findings on this phase indicate that before an innovation follows a certain diffusion pattern it undergoes an individual trial-and-error process, where fitting applications are sought for it. The length of this phase varies to a great extent and no individual factor clearly explains the variance in its duration. A firm's expertise in commercialization of innovations and in marketing has been stated to contribute to a more rapid pre-diffusion phase, though random factors like beneficial timing affect it as well (Tidd and Bessant, 2009, Chapter 8).

As a short pre-diffusion phase is beneficial and positive feedback from early adopters is crucial for a firm introducing an innovation to a market, it has to emphasize its customer relationship with the initial adopters of an innovation. Depending on the depiction of a market, they are either labeled as innovators or as lead users. This customer segment adopts innovations on average seven years before the typical user, is active in applying innovations and is perceived to be innovative by other market participants (Tidd and Bessant, 2009, Chapter 9). Diffusion models indicate that opinion these market participants develop towards an innovation influences heavily the adoption decisions of later adopters. Negative feedback from them may have devastating effects on further commercialization of an innovation (Chiesa and Frattini, 2011). This is why firms should listen to this customer segment carefully.

Diffusion theories thus imply that a firm bringing an innovation to a market should attempt to form a closer customer relationship with early adopters and listen to their views on an innovation carefully. In case they perceive it negatively, it is highly probable that wider market audience will perceive it likewise. Forming closer relationships may also assist in shortening the pre-diffusion phase of an innovation.

KEY FINDINGS

- **The classical generalization of markets assumes them to consist of a handful different customer segments in terms of their pace of adopting innovations. Only a minority of them will adopt innovations in a quick pace.**

- **Accurate diffusion models portray markets to consist of a mixture of individual decision makers and of participants that rely on experiences of previous adopters.**

- **A firm may be able to shorten the pre-diffusion phase and gather valuable feedback from an innovation by forming closer customer relationships with early adopters.**

The beginning of this subchapter discussed the commercialization of an innovation in general and indicated its key success factors. Following this discussion was a brief introduction to diffusion processes and to how they affect the commercialization of innovations. Research findings on this topic portray that initial customer segments that are targeted with an innovation and the positive experiences they gain of it, are crucial for an innovation's long-term success. As previous subchapters have shown, one may assess an innovation's adoption from multiple perspectives. In the next subchapter a framework will be formed, which will summarize the reviewed findings into a single analytical frame.

2.8. SYNTHESIS OF THE LITERATURE REVIEW

The literature reviewed in the previous subchapters introduces various research areas that relate to and thus contribute to defining factors that affect the adoption of new innovations. Owing to their varying perspectives they overlap to an extent and do not form a uniform whole. This is why a single analytical framework, which incorporates the findings from existing research and which will enable a systematical and conclusive analysis, is required.

The existing research offers the broadest research findings on bringing product innovations into a market. This is why these findings will form a basis for a universal framework on factors influencing adoption of an innovation. The research on this area consists of three viewpoints: innovation-led, customer-led and launch decisions -led. In the innovation-led viewpoint, the characteristics of an innovation are mainly assumed to define the pace of its

adoption (Tidd and Bessant, 2009, Chapter 8 and Rogers, 2003). In the customer-led viewpoint, the customer's practical objections and psychological blocks are primarily assumed to define its adoption decision (Sheth and Ram, 1987, Chapter 3 and Tidd and Bessant, 2009, Chapter 8). In the launch decisions -led viewpoint, the strategic and tactical launch decisions regarding an innovation are key variables in defining its success (Hultink et al., 1997 and Guiltinan, 1999). All of these viewpoints have merits, though individually they lack factors explaining the adoption of an innovation.

Factors from both innovation-led and customer-led viewpoints influencing the trial and adoption of a product innovation are combined into one whole in the literature review (see Figure 5 on Page 46). In the context of this research, these factors are labeled as direct factors influencing trial and adoption of an innovation as they can be assessed to each customer group in order to explain their adoption behavior. The launch decisions -led viewpoint does not similarly explain the behaviors of market participants, but portrays surrounding market environment and applied marketing measures. According to it, the appropriate combinations of strategic and tactical launch decisions lead with higher probability to the adoption of an innovation (Hultink et al., 1997). As the combinations of strategic and tactical launch decisions determine the trial and adoption of an innovation, these two decision categories have to be considered together as one influencing factor: launch decisions -factor. By combining direct factors and launch decisions -factor one is able to form a single framework, which represents the existing findings on general factors influencing the trial and adoption of an innovation. Formed framework is presented in Figure 16.

The framework has been constructed based on research findings on bringing product innovations into a market, though it is conclusive on general factors influencing the trial and adoption of an innovation. To ensure the framework's conclusiveness in terms of different research areas, the underlying elements of its general factors will be defined in a manner that incorporates relevant research findings from reviewed research strains. This discussion will be carried factor by factor in the following paragraphs.

Relative advantage consists of the price-to-performance ratio of an innovation compared to price-performance ratios of existing offerings. The assessment of price-to-performance ratio requires the assessments of both relative benefits and relative costs of an innovation (Guiltinan, 1999).

As research findings indicate, the customer value consists of both economic and non-economic components and as latter components are often difficult to assess, the relative benefits of an innovation are not completely measurable (Rogers, 2003 and Whittaker et al., 2007). The most concrete aspects of it, quality and functional components of value (Whittaker et al.'s (2007) components of value on Table 2 on page 29), may however be measured. These components of value are defined to constitute relative benefits in the framework. Other components of value are included in the compatibility and image barrier factors of the framework, which is why their assessment as part of the relative advantage is not relevant. As customers perceive and measure value differently, assessments of relative advantage have to be conducted to similar customer groups or at times even to individual customers (Tidd and Bessant, 2009, Chapter 8).

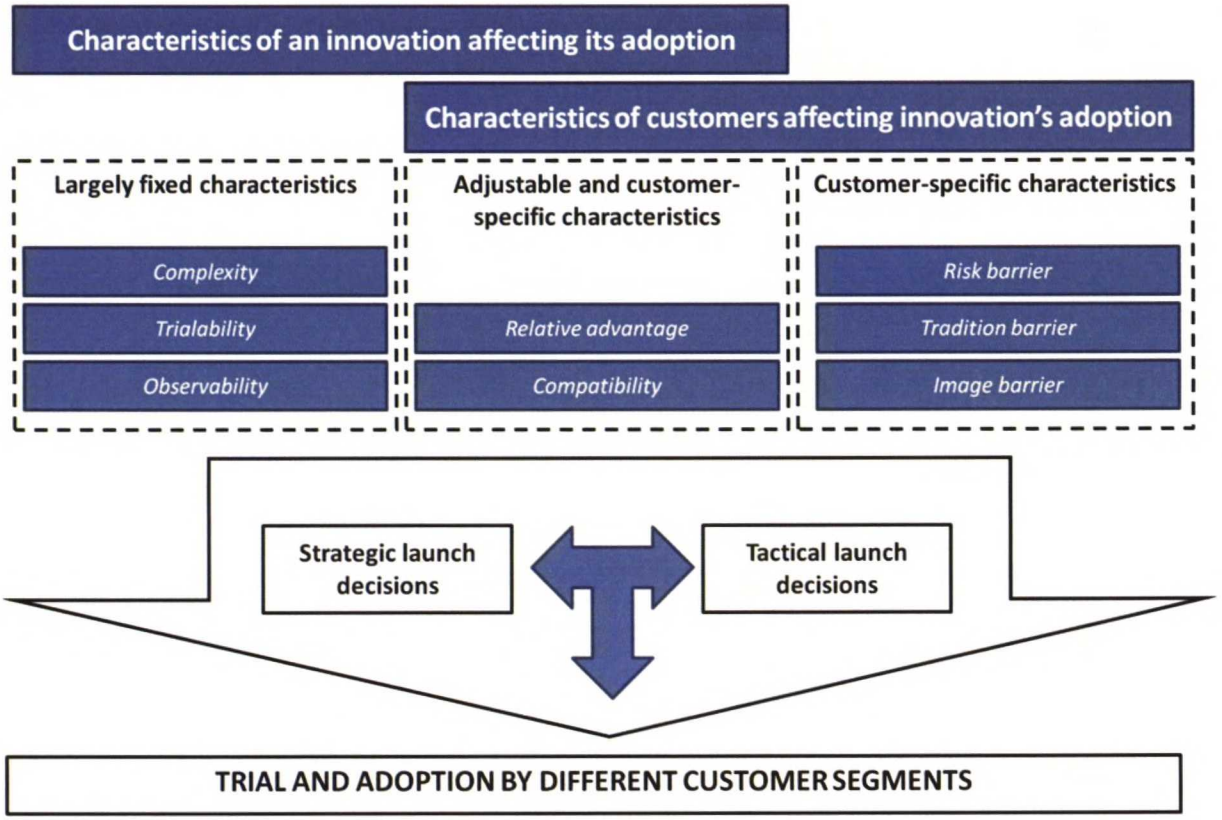


Figure 16. Framework portraying factors influencing trial and adoption of an innovation

In the framework the relative costs of an innovation consist of monetary costs required to obtain desired benefits. A broad perspective of relative costs is to consider costs that arise of transportation, installation, order handling, inventory carrying and potential product failures in addition to an offering's price (Hutt and Speh, 1995). The ones applicable in each case should be included into the analysis. As one is assessing the relative costs of an innovation it has to be compared not only to its direct competitors, but to a wider array of available solutions to which potential customers may compare it to (Guiltinan, 1999 and Kim and Mauborgne, 2005).

As the relative advantage is a key success factor in regard to product and service innovations (Brentani, 1991, Brentani and Ragot, 1996, Brentani, 2001 and Tidd and Bessant 2009, Chapter 9) its assessment is at the core of the framework. As Cooper's (2000) findings indicate, the extent of relative advantage correlates with the success rates of innovations. This is why the relative advantage is a noteworthy indicator of an innovation's general potential in a market.

In product innovation literature **compatibility** is defined to consist of two perspectives. The first viewpoint is to assess whether an innovation fits with the existing skills, equipment, procedures and performance criteria of an organization. The second viewpoint is to assess whether an innovation fits with the existing values and norms of an organization (Rogers, 2003). The first viewpoint of this definition combines several elements, which do not form a logical unit of analysis. This is why the compatibility is redefined in the framework to consist of *technological fit* and *usage fit*. T*echnological fit* consists of assessing whether an innovation fits with the existing equipment (Rogers, 2003) and system architecture of a customer (Chiesa and Frattini, 2011). *Usage fit* consists of assessing whether an innovation fits with the existing customer's processes (Rogers, 2003), with customer's skills and knowledge (Guiltinan, 1999 and Kaario et al., 2003) and with the values and norms of a customer's organization (Rogers, 2003). Redefining the compatibility in this manner enables

more logical units of analysis and incorporation of research findings from other research areas as well.

An innovation's fit to an existing equipment of a customer resembles the concept of *technological fit* for the most part. The difference is in that the *technological fit* consists both of an innovation's fit with existing equipment and of its fit with existing system architecture. As technological innovations in industrial markets are typically parts of wider systems, their compatibility with surrounding systems is a defining factor in the customers' adoption decisions (Chiesa and Frattini, 2011). The effects of incompatibility may be significant as achievable benefits with an innovation may be counteracted by costs that arise of required system changes to obtain them (Tidd and Bessant, 2009, Chapter 9). This is why an innovation's fit with the existing system architecture is a relevant additional element to be assessed.

The *usage fit* combines non-technological elements of fit into one unit of analysis. Here the elementary question is whether an innovation fits to the customer's existing processes. The more an innovation requires changes, the less compatible it is (Rogers, 2003). The compatibility also links to the skills and knowledge of the customer's organization. If the value of the customer's prior experience or knowledge diminishes when it chooses to adopt an innovation, the compatibility is lowered. The same applies to a customer that has to acquire new skills or knowledge to adopt an innovation (Guiltinan, 1999). As the customers' levels of technical knowledge vary, the provider of an innovation may mitigate negative effects from these by designing appropriate offerings and sales processes to similar customer segments (Kaario et al., 2003). Difficult to assess elements of *usage fit* are existing values and norms of an organization. Besides the performance criteria of an organization, they are largely immeasurable. Despite of this they bear significance to the customers' adoption decisions (Rogers, 2003).

Research has shown that innovations typically do not fit the user environment they are introduced to. Over time either targeted organizations, innovations or both adapt to increase compatibility. The most successful innovations have been the ones, where both targeted organizations and innovations have transformed to reach mutual compatibility (Tidd and Bessant, 2009, Chapter 8). This implies that compatibility is a time-dependant factor and not a constant over an innovation's life-cycle. As research findings on bringing product innovations into a market have consistently indicated, compatibility is a significant factor in explaining the trial and adoption by different customer segments (Guiltinan, 1999) This is why the compatibility is to be considered after relative advantage as the factor with the most significant effect on trial and adoption of an innovation in the framework.

The **risk barrier** is a customer-specific factor, whose significance is determined by uncertainties that a customer perceives relating to an innovation. For example, a customer may perceive an innovation's benefits to be uncertain or a customer may perceive adoption of an innovation to lead to unanticipated side effects, both of which result to a degree of risk being present in the defining adoption decision (Sheth and Ram, 1987, Chapter 3). These uncertainties stem from the customer's own perceptions, but the characteristics of an innovation may enhance or reduce them. Especially the innovation's **complexity**, which portrays how difficult to understand customers perceive an innovation, its **trialability**, which represents whether an innovation may be experimented before the purchase decision, and its **observability**, which indicates how visible benefits of an innovation are, are determinants of a risk barrier (Rogers, 2003 and Tidd and Bessant, 2009, Chapter 8). Owing to these reasons, the underlying elements of the risk barrier are defined to be the customer's perceptions of uncertainties and the manner in which the customer perceives specified characteristics of an innovation. Largely fixed characteristics of an innovation will not be assessed separately in the framework as their indirect effects are most notable in the risk

barrier factor. Nevertheless, their separate status in the framework is justifiable as they may affect the trial and adoption of an innovation through other factors as well.

The **tradition barriers** arise of cultural changes necessitated by an innovation in the adopting organization. The nature of these cultural changes may not be specified as they might arise of any area of an organization. A concrete example of them would be a case where the adoption of an innovation would reduce the need for a task that has been traditionally carried out by a specified unit in an organization. Required organizational changes of this might pose a significant barrier for adoption (Sheth and Ram, 1987, Chapter 3). As no clear underlying elements of tradition barrier may be defined, a general term of psychological switching costs will be used in the framework. It represents how tradition barriers of an organization arise of changes linking to its people and not of changes linking to its equipment, which are generally portrayed with technical switching costs.

Innovations have a certain image that stems from their origins. **Image barriers** form if these associations are negative. Typically the image of an innovation comprises of the corporate image of the firm introducing it and of the image of the applied technology itself (Sheth and Ram, 1987, Chapter 3). According to Weiss and Heide's (1993) research on customers' buying behaviors are affected by their perceptions of technology's newness, of its rate of change and of the differences between different applicable technologies. This is why at least these perceptions regarding a technology have to be considered when assessing the significance of the image barrier. As no clear definition of an image exists, the underlying elements of the image barrier are defined in the framework to be corporate image of a provider and the customers' perceptions of applied technology.

Table 6 presents an overview on underlying elements of direct factors influencing trial and adoption of an innovation. Through analyzing these underlying elements one is able to understand respective general factors and the customers' behaviors in detail.

Table 6. Underlying elements of direct factors influencing trial and adoption of an innovation

Factor	Underlying elements
Complexity	(Indirect effects through other factors)
Trialability	(Indirect effects through other factors)
Observability	(Indirect effects through other factors)
Relative advantage	Benefits of a new offering vs. Benefits of comparable solutions Costs of a new offering vs. Costs of comparable solutions
Compatibility	**... in terms of technology** - Existing system architecture - Existing equipment **... in terms of usage** - Existing processes - Existing skills and knowledge of customer's organization - Existing values and norms
Risk barrier	Uncertainties and potential unanticipated side effects Perceptions on an offering's complexity, trialability and observability
Tradition barrier	Psychological switching costs
Image barrier	Corporate image of the provider Perceptions of applied technology

Underlying elements of direct factors influencing trial and adoption of an innovation may be assessed one by one to reach a conclusion on the significance of the whole factor. With launch decisions -factor this type of assessment is not possible as its underlying elements, **strategic and tactical launch decisions** (see Figure 6 on Page 20), affect trial and adoption of an innovation as combined sets of decisions. In addition, as markets vary universal sets of decisions, which would be superior to others, may not be defined (Hultink et al., 1997). This is why launch decisions -factor has to be assessed in a comprehensive manner as a whole.

Existing research regarding launch decisions -factor provides insights on how assessments of an innovation's characteristics, of its potential customers, and of its competitors assist in defining an effective launch plan for it. A number of components of an effective launch plan have been identified to be definable through such assessments. These assessments do not though form a conclusive view on strategic and tactical launch decisions, which shows deficiencies in our existing research. These key assessments that assist in defining an effective launch plan will be discussed in the following paragraphs. In addition, a few general characteristics of an effective launch plan will be revised.

The first key assessment is the identification of customer segments, in which an innovation is able to create additional benefits to customers (Kim and Mauborgne, 2005, Chapter 6; Mullins, 2006 and Jolly, 1997, Chapter 8). The assessment's results will influence targeting decisions in a launch plan, affect the firm's decisions on which markets it is going to compete in and enable efficient marketing as potential customer groups have been identified. Optimally this assessment should identify at least one attractive target segment that benefits greatly from an innovation. This segment would then form a natural initial customer group for an innovation (Tidd and Bessant, 2009, Chapter 9 and Chiesa and Frattini, 2011). Without a

sufficient amount of initial customers, a new offering or an innovation may remain in a pre-diffusion phase as it is not a superior solution to adequate amount of applications (Tidd and Bessant, 2009, Chapter 8)

The second key assessment is to analyze the relative newness of the offering. This information indicates what kind of buying behavior patterns will be aimed to be stimulated with a launch plan. Depending on the offering's relative newness one has to convince the customers to either adopt a completely new solution, switch their existing solution to an improved offering or start using a new offering instead of other similar solution (Guiltinan, 1999). As different approaches promote each of the buying behavior patterns, an effective launch plan has to be designed knowing which buying behavior is to be promoted.

The third key assessment is to analyze the key characteristics of an innovation and based on them determine a fitting launch plan, which mitigates negative characteristics of an innovation and capitalizes on its positive characteristics. According to Guiltinan (1999) te relative advantage and compatibility are innovation's key characteristics according to which pricing, promotion and distribution approaches and breadth of the product line should be determined. The author's own analysis on links between relative advantage, compatibility and these tactical launch decisions is presented in the literature review (see Figure 8 on Page 23). This representation is though solely a recommendation on adequate approaches. The key message the author aims to convey is that one should minimize negative characteristics of an innovation and capitalize on the positive ones with all conceivable measures in an effective launch plan (Guiltinan, 1999).

The fourth key assessment regarding launch decisions is to identify the relevant customer barriers that may block the adoption of an innovation and consider whether specific actions have to be taken to mitigate their effects. According to Sheth and Ram (1987, Chapter 3) plausible options range from re-designing innovation's offering to using specific promotion measures against specific customer barriers. Detailed descriptions of proposed counteractions to specific customer barriers have been reviewed in the literature review (see pages 24-25). As the goal of these specific measures is to enhance trial and adoption of an innovation, they have to be considered as parts of a launch plan.

Besides being based on certain rational assessments, an effective launch plan has certain general qualities as well. According to existing research, effective marketing communication, which is an integral part of a launch plan, reaches all the required participants to a buying process, while influencing the primary targets with more specific measures (Kitcho, 1998, Part One and Tidd and Bessant, 2009, Chapter 9). In addition, an effective launch plan takes into account that opinions of initial customers and early adopters influence adoption decisions of later adopters to a great extent (Chiesa and Frattini, 2011).

As the previous discussion indicates, an efficient launch decisions -factor may be defined by assessing the innovation's characteristics, its potential customers and its competitors, and by specifying a launch plan according to the obtained results. In addition, few general qualities of an effective launch plan have to be taken into account to further optimize trial and adoption of an innovation. Launch decisions -factor is thus only specifiable through the assessments of other factors in the framework. This is why it is not an independent factor, but a factor that is dependent on the surrounding conditions. Its fit with other factors in the framework may be thus analyzed, but individually it may not be assessed.

By first defining the underlying elements of each of the general factors in the framework one is able to form a single analytical framework, which incorporates findings from existing research and which will enable a systematical and conclusive analysis of factors influencing innovation's trial and adoption. The framework presented in Figure 16 and the previous definitions of its general factors will thus serve as this research's framework. The framework

will be applied in the empirical part of the research to test its applicability to a concrete case and to assess its factors and their links in detail.

A few details of the framework are noteworthy. While direct factors influencing trial and adoption of an innovation have been defined based on research findings from various research strains, launch decisions -factor is based on scarcer academic background. As it has been widely discussed in the literature on bringing product innovations into a market, it may not be directly applicable to other types of innovations. In addition to this, existing research does not offer conclusive findings on specifying an effective launch plan. This is why only an incomplete view on this factor may be formed. Finally, as researchers have presented their findings on factors influencing trial and adoption of an innovation on a general level, relevant underlying elements or even additional factors may be missing from the framework. These potential additional elements will be assessed in the empirical part of the research.

3. RESEARCH METHODOLOGY

3.1. RESEARCH APPROACH

To answer the set research questions and for to be able to provide applicable recommendations to Case firm both theoretical knowledge and empirical insights are combined in this research. This research method may be classified as a normative case study, whose focus is on proposing a solution to a relevant practical problem. In terms of different research approaches it is one form of a constructive research approach, whose positioning in regard of other research approaches is depicted in Figure 17 (Lukka and Tuomela, 1998).

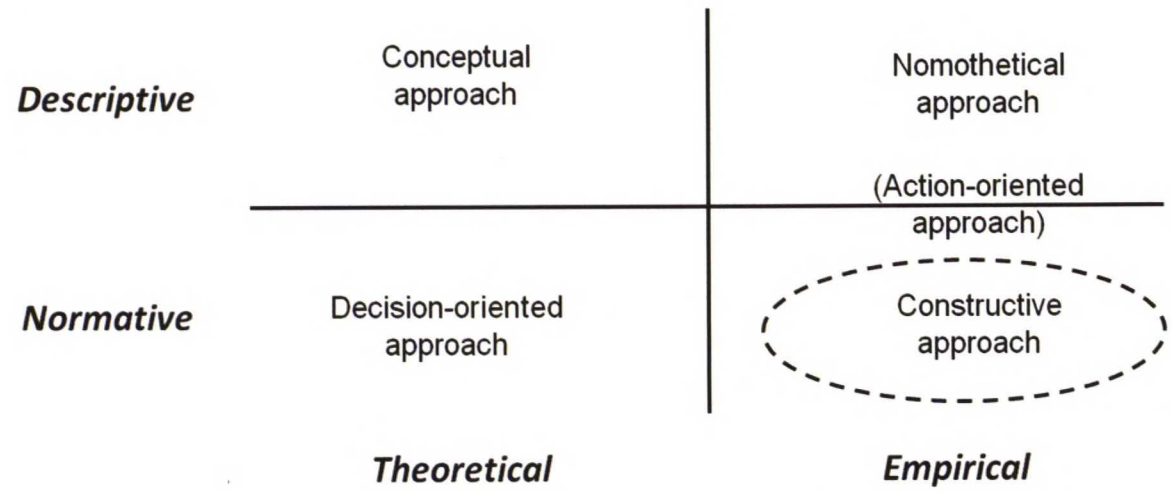


Figure 17. Representation of differences between various research approaches (Lukka and Tuomela, 1998)

Kasanen et al. (1991) have defined general steps of a constructive research approach to be following:

1. *Find a practically relevant problem which also has research potential*
2. *Obtain a general and comprehensive understanding of the topic*
3. *Innovate and construct a theoretically grounded solution idea*
4. *Demonstrate that the solution works.*
5. *Examine the scope of applicability of the solution.*
6. *Show the theoretical connection and the research contribution of the solution concept (Kasanen et al., 1991)*

This research will proceed according to these steps as well. As demonstrating that a solution works is a demanding task, it is conducted in a limited manner in this research. Kasanen et al. (1993) have specified three levels of market-based validation one may reach. Passing a weak market test means that managers are willing to apply research's results to an actual problem. If research's results are adopted widely by companies, then they have passed a semi-strong market test. Finally, passing a strong market test requires companies applying research's results to produce systematically better results than their peers not applying it. Weak level of validation is thus considered acceptable in the context of this research.

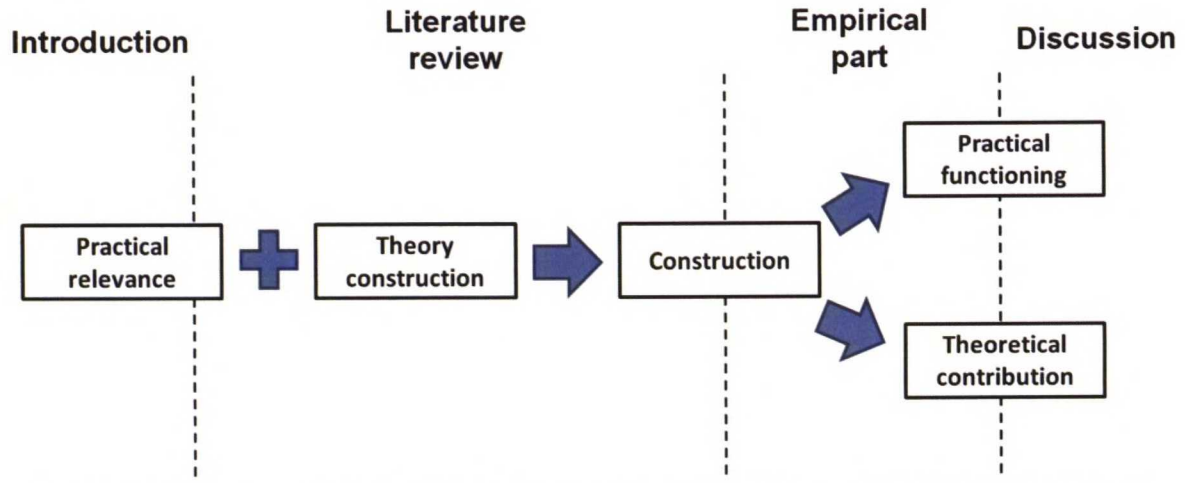


Figure 18. Depiction of general steps in a constructive research approach (Kasanen et al., 1991)

Figure 18 portrays how different sections of this research link to Kasanen et al.'s (1991) general steps of a constructive research approach. As is shown research's approach is theory-led as construction, that is an applicable framework, is formed over the course of the literature review and its contents are thereafter verified and specified further in the empirical part of the research. Examining the scope of applicability of the solution is a step missing from the above, but analysis on it will be conducted in the Discussion-part of the research paper.

Main sections of the research, literature review and empirical part, are specified in the following subchapters.

3.2. LITERATURE REVIEW

As trial and adoption of an innovation is a wide theme, multiple research areas contribute to defining a general framework explaining the phenomenon. In the literature review wide enough of an approach is sought by reviewing findings from bringing both product and service innovations into a market and by analyzing peculiarities in trial and adoption of high-technology innovations. In addition, findings on general factors which contribute to success of an offering are reviewed shortly.

As literature is approached from a wide-angle, works that overview several research areas form a background to the literature review. General-level findings described in these works are deepened by reviewing further sources on themes, which are identified to be relevant. Typically works that overview several research areas are textbooks compiled by one or several authors, while further sources are academic research papers on individual themes. Literature review will mainly discuss findings described in research papers, though individual textbook sources are included in the described manner as well.

Books and research papers in the literature review are both academic and semi-academic in nature. In the context of this research academic sources are peer-reviewed research papers, which have been published in respectable academic journals. Semi-academic sources on the other hand are books published by academic authors on specific themes. Findings described in them are typically based on legitimate research, though their content has not been peer-reviewed. As both types of sources have an academic background, they are considered trustworthy sources for the literature review.

Reviewed literature has been identified by using available search engines with keywords that relate to the theme. As in some research areas it was not feasible to review all research papers written on a theme, more recent research papers were favored. Relevant older research papers were then identified mainly through them. As empirical part of the research links to technological innovations and industrial markets, research papers discussing these types of conditions have been favored over the research process. This limits general applicability of literature review's outputs.

Based on reviewed literature a comprehensive and practical framework indicating factors influencing trial and adoption of an innovation is formed. Relevant reviewed research findings are included into it and its logicality is ensured by eliminating potential overlaps between different research areas. Framework's purpose is to be a base-model, on top of which further researchers may add their findings. Its applicability in different kinds of conditions may be thus enhanced with further specifications.

3.3. EMPIRICAL PART

3.3.1. COLLECTION OF EMPIRICAL DATA

Empirical part of the research consists of a case study, whose aim is to confirm existing research findings on factors influencing trial and adoption of innovations and to extend our understanding in areas, which are specific to this case. As Yin (2003) states:

Case studies are rich, empirical descriptions of particular instances of a phenomenon that are typically based on a variety of data sources.

Typically main data source in case studies is qualitative evidence, which is supported by various secondary data sources (Eisenhardt and Graebner, 2007). In this research main data source is qualitative data collected in interviews of Case firm's customers. Secondary data sources are Case firm's internal materials on costs and qualitative data collected in interviews conducted within Case firm. The reliability of the research is sought to be increased according to the principles of triangulation approach by collecting information from different data sources (Hirsjärvi and Hurme, 2001, Chapter 2).

Interviews have been chosen as the main method of collecting empirical data, as in business marketing research they are an applicable way to acquire relevant information and as with them one is able to gather deep insight into a theme (Hutt and Speh, 1995). While interviews provide one with more descriptive data, their efficiency and reliability, which have to be considered when choosing a research method, are of lower level (Hirsjärvi and Hurme, 2001, Chapter 2). Despite of their deficiencies interviews are a feasible solution as research's aim is to deepen our understanding of a phenomenon in certain specific circumstances.

If interviews are considered on a continuum from structured to unstructured, interviews conducted in this research fall between these two extreme approaches. Hirsjärvi and Hurme (2001, Chapter 4) have labeled these types of interviews as theme-interviews. In them key aspects of an interview, for example questions and central themes, are kept similar, while other aspects like order of questions and interview's emphasis may vary. This type of interview approach allows a researcher to concentrate in interviews to topics, to which interviewees are able to contribute significantly.

Both theoretical and empirical researches progressed simultaneously as is typical in a qualitative research process (Hirsjärvi and Hurme, 2001, Chapter 4). This is why questionnaire defining themes to the interviews developed over the research process.

Empirical part of the research started out with *five* interviews where initial questionnaire was piloted and developed further. Following these interviews were *six* interviews, where 1st version of the questionnaire defined the main themes. 1st version of the questionnaire is presented in the Appendix I. 2nd and final version of the questionnaire was formed based on at that point gathered data and additional theoretical insights. Final questionnaire defined discussion themes to the last *thirteen* interviews. Final version of the questionnaire is shown in Appendix II. Key differences between 1st and 2nd versions of the questionnaire are that in latter elements of the questionnaire are represented in a more understandable manner to interviewees and that the structure of the latter follows theoretical framework of the research more accurately.

According to Hirsjärvi and Hurme (2001, Chapter 4) interview sample should be defined and reviewed in a following manner:

1. Decide what kind of people you should interview
2. Decide how many people you will interview
3. Decide, whether you handle them as one group, divide them to subgroups or handle them as a group of individual interviews
4. Interview everyone in every group if it is a plausible solution. If it is not possible, pick a random sample of each group.
5. At the end of the research analyze critically the whole sample and individual interviewees (Hirsjärvi and Hurme, 2001, Chapter 4)

This research's approach to items one, two and four is described in the following paragraphs. Item three will be discussed in the description of the empirical analysis and item five will be analyzed as part of this research's limitations.

To understand factors influencing trial and adoption of a new offering Case firm's customers, which are maintenance organizations in various industries, were chosen as the main target of the research. Within these maintenance organizations employees responsible for activities corresponding to Case firm's offering were aimed to be interviewed. If an individual person responsible for a similar activity could not be identified, head of the maintenance organization was interviewed instead. As research was constrained by limited resources it focused only on two industries, namely A and B. These two industries were chosen because they represented two potential customer groups for the Case firm's new offering and combined they contained an amount of reachable firms, which could be studied in the context of this research. In concrete industries A and B contained combined less than eighty facilities with maintenance organizations, most of which were located in southern and western parts of Finland. In addition, few interviews were conducted in two other industries, C and D, as well. Additional interviews were planned to be conducted in industry C, though as initial research indicated that maintenance responsibilities are divided in a complicated manner in that industry no further interviews were booked. This decision was made as impacts of organizational structures and divisions of tasks to trial and adoption of a new offering are not the main focus of this research.

In the industries to which the research focused on a representative of each maintenance organization was aimed to be interviewed to form a comprehensive view on relevant factors influencing trial and adoption in them. In industry A approximately two thirds accepted interview request, while same figure in industry B was one fourth. Noteworthy of the refusals is though that they contain sites and maintenance organizations, which do not have applications to which new offering would fit. This holds true especially in industry B. This is why the proportion of relevant interviewees that were interviewed in industry B is higher than the acceptance rate to interviews indicates. Interviewees having knowledge of similar offering than Case firm's one or having experience with activity relating to new offering accepted interview requests with a higher probability than other interviewees. Interviewees

who had already implemented a similar solution though had a higher probability of refusing from an interview. In addition, Case firm's existing customers accepted interview requests more often than firms that did not have a clear customer relationship with the Case firm. These differences in acceptance rates biased research's sample to an extent.

First concrete part of the research process was to identify potential interviewees. This was carried out using an online contact tool, which offered the possibility to classify contacts according to an industry. Industry classification provided by this tool is used consistently in this research. For to be able to identify firms with own maintenance organizations more efficiently a certain limit was set to their annual net sales. Set limit did not assumedly cut out relevant interviewees as obtained list of firms contained several organizations, which were from their size still too small. Second step was to contact identified interviewees over the phone and agree an interview with them. A short introduction to the topic was given in this interview request to ensure that maintenance organization was responsible for activities linking to new offering. Typically representatives of maintenance organizations refused of an interview at this point if they were not responsible for applications fitting for the new offering or if they had recently implemented a similar solution. Third step was concrete interviews that were carried out following previously introduced methodology and questionnaire. Noteworthy of interviews is that in several of them several representatives of a maintenance organization were present. This enabled more detailed description of a maintenance organization and its activities, though with representatives having varying opinions on topics it adds complexity to the interpretation of the results. Besides piloting phase interviews were recorded if interviewees gave permission to do so. Either based on recordings or on made notes, detailed notes of each interview were written, which served as the base data for the analysis.

In addition to interviewing Case firm's potential customers, two official interviews and a workshop were conducted within the Case firm. Two interviews were done with senior members of the Case firm to understand technical limitations and costs of relating offerings and to discuss initial research findings and their implications with a senior sales manager. In the workshop research's findings were reviewed with a three-member team and their implications to various factors of the research framework were discussed. In addition, team members reviewed factors influencing trial and adoption of a new offering and indicated whether they consider revised research framework logical and applicable in future work. This resembles a weak-market test, which indicates whether research findings are applicable in concrete. Interviews conducted within the Case firm were based on pre-set themes and thus no separate questionnaires were prepared for them. Notes on them though were made.

In the previous paragraphs key aspects of how empirical data for this research was collected has been discussed. Appendix III contains described key information of the made interviews in a compact format. In the next chapter analysis of this data will be overviewed.

3.3.2. ANALYSIS OF EMPIRICAL DATA

Collected data, which predominantly is qualitative, is analyzed in the empirical part of the research in detail to understand different factors influencing trial and adoption of the new concept. Relative values that may be defined to these factors and potential links between them are sought by reviewing a mass of qualitative data in a comprehensive manner. Qualitative research approach, which is applied to assess majority of factors in the research framework, is described in the following. Other research approaches, which are used in this research to analyze few individual elements of the research framework, are described thereafter.

In the conducted interviews key aspects of an interview were kept similar, while order of questions and emphasis of interviews varied. To enable uniform analysis of results, obtained

insights were written down into a similar structure. Based on information of these documents an Excel-table was created, which contained top-level results for each of the questions from conducted 24 interviews. This table enabled analysis of each of the research framework's factors.

Analyses on individual factors were carried out by identifying commonalities in customer groups with similar attributes. Bases for customer grouping were either common industry or similar unit size. After having identified significant similarities, notes in the documents were reviewed to understand backgrounds behind customers' answers. Based on this information conclusions on factors were drawn. No specific word-analysis was carried out, but general content of customers' answers was considered to be adequate level of detail.

This research approach relies heavily on qualitative information received from interviewed organizations. As answers were attempted to be grouped before analyzing tendencies, possibility to an individual misunderstanding is minimized. Questionnaire was also attempted to be designed in a manner that answers to questions may translated into assessments on different factors of the research framework. Especially on fully qualitative factors like risk, tradition and image barrier -factors this was though a challenge.

In addition to wide qualitative assessments, few underlying elements were analyzed based on a different research approach. Costs of the new concept were calculated based on available pricing tool from Case firm and costs of competing offerings were calculated based on assumptions which are spelled out in detail in Results-section of this paper. Research approach with launch decisions -factor was to combine theoretical insights and both results from qualitative assessment and insights from workshop with Case firm's representatives to reach recommendations on how an optimal commercial offering of the new concept should be designed. This approach is at best semi-scientific, but as this area is not the focus of this research this is considered acceptable.

3.4. RELIABILITY AND VALIDITY OF THE RESEARCH

Validity and reliability of a case study are often matters of concern. Because a case study is often unrepeatable in exactly similar context, methodological rigor in it has to be followed. Various criteria for assessing the validity and reliability of case studies exist, but commonly they are reviewed through four viewpoints that are presented in Table 7 (Gibbert et al., 2008).

Table 7. Criteria for assessing validity and reliability of a case study according to Gibbert et al. (2008).

1. Internal validity	2. Construct validity	3. External validity	4. Reliability
Does research have a clear research framework, which is adapted from literature?	Has the data been collected, also known as triangulated, from various sources?	Has the context of the case study been explained in detail?	Has the case study been reported and conducted in a transparent manner?
Are found patterns matched to the predicted ones from the literature or to those reported by other authors?	Is a clear chain of evidence established?	Have multiple case studies been conducted to enhance external validity?	Can the case study be replicated (in a different context)?
Have findings been verified through interpreting results with different theoretical lenses and bodies of literature?	Has data been validated by a 3rd party and have circumstances, where it was collected, been clearly explained?	Is there a clear rationale for case study selection?	

In this research internal validity is sought by conducting an extensive literature review as part of the research and by linking obtained empirical findings to the existing knowledge. As theoretical contribution of the research is to specify factors influencing trial and adoption in case study's conditions in more detail, comparisons with existing research findings are a natural part of it. Construct validity is aimed by applying limited triangulation approach to data collection and by defining measured factors in manner that they consist of several individually measurable components. Smaller entities, which as a combination form the whole, are more measurable than larger and more complex units. Following Yin's (2003) recommendations on how to ensure the reliability of a research a separate database for all the collected data in the case study was kept and this research is reported in as transparent manner as possible. Typically case studies have a weak external validity, which applies for this research as well (Gibbert et al., 2008). Wider research in this specific case and on similar cases would increase external validity of this research, but due to limited resources they remain outside the scope of this research. This is why results remain subjective and difficult to generalize.

4. EMPIRICAL ANALYSIS: CASE STUDY IN INDUSTRIAL SERVICES MARKET

4.1 CONTEXT OF THE CASE STUDY

Case study analyzes factors influencing the trial and adoption of Case firm's new offering in industrial services market. Industrial services market is a business-to-business market, which divides into several subcategories. Relevant subcategory for this research is maintenance services. According to a classification maintenance services may be categorized into mechanical and electrical maintenance services. Case firm's new offering is a form of a mechanical maintenance service. Mechanical maintenance services are thus the area of industrial services markets which form the context for the research.

Maintenance measures are either corrective or preventive in manner. Corrective maintenance is conducted after an equipment failure has taken place. Preventive maintenance on the other hand is conducted before a break down occurs and its aim is to minimize unexpected equipment failures (Huang et al., 2005). Respectively most elementary maintenance strategy that firms deploy is a corrective maintenance -strategy, where equipment failures are responded with appropriate maintenance measures. More advanced maintenance strategies aim to increase the utilization rate of the equipment by applying preventive maintenance measures. In time-based maintenance -strategy maintenance is undertaken over certain time intervals to ensure functionality of the equipment. These time intervals may be defined as fixed amounts of days or as fixed amounts of operation hours of equipment. In predictive maintenance -strategy condition of equipment is monitored and maintenance measures are carried out as a response to deteriorating equipment. The more information one has of the condition of the equipment, the more advanced predictive maintenance -strategy one may implement (Huang et al., 2005). Maintenance strategy based on condition monitoring is able to preempt more fault patterns than other maintenance strategies, which is why it is considered to offer incremental benefits versus them. Failure patterns of bearings shown in Figure 19 exemplify this (Hashemian, 2011).

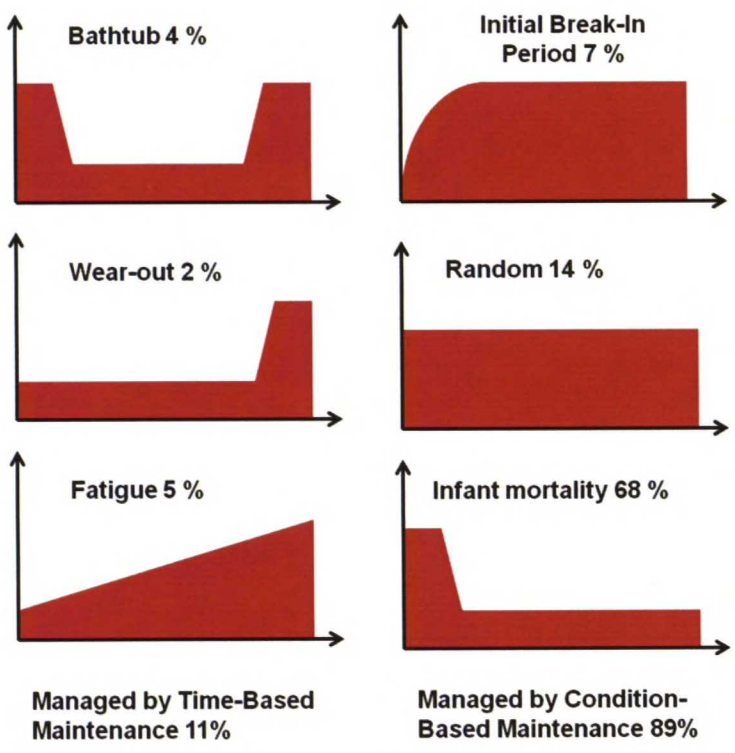


Figure 19. Failure patterns of bearings according to Hashemian, 2011.

Firms pursue predictive maintenance -strategy with various approaches, which differ on investments to condition-measurement-instruments. An elementary form of predictive maintenance strategy is to rely on human senses in observing condition of equipment. More exact information on condition of equipment is obtained by investing into portable measurement devices with which condition measurements may be carried out manually. Key deficiency of portable measurement devices is that they provide one with information on condition of equipment only at a certain point of time, that is when measurements are carried out. As measurement cycles are typically long, long periods of time exist when condition of equipment is unknown. To have continuous information on condition of equipment one may either install individual condition-monitoring-solutions to specific devices or a condition-monitoring-system to multiple devices. Latter requires extensive investments to local infrastructure and systems, which is why it is mainly applied in units with numerous devices (Case firm's technical expert). Case firm's new offering is an individual condition-monitoring-solution combined with analysis services. It thus aims to enable advanced predictive maintenance -strategy and benefits related to it in customer's facility.

Main benefit of the predictive maintenance -strategy is the minimization of equipment downtime by being able to prevent unexpected equipment failures in a facility. In addition, predictive maintenance -strategy maximizes components' life and performance by minimizing operation conditions that could be harmful to equipment (Lee et al., 2006). Each of the introduced approaches to predictive maintenance -strategy enables these benefits to a degree, though full benefits of it are assumed to be reached with continuous condition monitoring solutions and systems (Case firm's technical expert). Extent of obtainable benefits depends on attributes of a facility. Defining factors are how critical is system downtime and how expensive is unscheduled maintenance. The higher the costs related to these are, the higher the benefits associated with advanced predictive maintenance -strategy presumably are (Lee et al., 2006). These benefits are though difficult to measure as they consist of costs that were able to be avoided.

Veldman et al. (2011) researched how process industry companies in Netherlands apply condition-based maintenance in practice. Their key finding is that these particular companies are lacking a systematic approach to condition monitoring. Both processes, systems and employee training are areas in which researchers found deficiencies. Considering that benefits of advanced predictive maintenance -strategy should be significant in process industry (Veldman et al., 2011), their findings are surprising. If these findings represent state of matters in process industry at large, indication is that condition-based maintenance is still a developing area of activity in companies.

Portable condition monitoring devices have been commercially available for decades, while continuous condition monitoring solutions have been available since 1990s. Case firm's new offering is thus not a new-to-the-world offering, but an improved version of existing techniques. This is why Case firm's new offering is entering a market, where existing solutions have already been implemented (Case firm's technical expert). New offerings differs from its peers in that it is not a simple technical device, but a combination of a continuous condition monitoring solution with analysis services, which assist customers in understanding condition of their equipment in a more accurate manner. Due to its nature of being a mixture of product and service components classification of Case firm's new offering to one of these groups is not straightforward. Ratio of its labor costs to equipment costs, which is one measure defining whether an offering is a product or a service (Berry et al., 2006), shows that with shorter contract periods product and service costs are in equal proportion, while with longer contract periods service components represent main costs of the offering. In this respect Case firm's new offering represents more of a service than a product. Second measure whether an offering is a product or a service is the degree of interaction with customers (Berry et al., 2006). As interactions with customers are rare, Case

firm's new offering represents in this measure only slightly a service offering. As customers' views ultimately determine classification of an offering (Hutt and Speh, 1995, Chapter 12), these two unclear assessments do not with certainty determine whether Case firm's new offering is perceived more of a product or a service offering.

Case study's context is thus industrial services market and more specifically mechanical maintenance services. In the scope of mechanical maintenance services Case firm's new offering is a condition monitoring solution that soughs to preempt equipment failures. Its benefits are indirect in nature as they consist of costs that are able to be avoided. New offering thus belongs to a category of offerings, whose benefits are difficult to show in concrete and quantify. As the new offering is a mixture of product and service components it is a new type of an offering, a new concept, in the market. Pure product and service offerings seeking to fulfill similar needs have been though available for a considerable time-period. Limited research on the topic indicates that condition monitoring is not yet conducted in a professional manner everywhere. This may affect customers' perceptions of Case firm's new offering.

4.2. OVERVIEW ON CASE STUDY'S ANALYSIS

In the case study factors influencing trial and adoption of Case firm's new offering are analyzed. Analysis will proceed following general factors influencing trial and adoption, which are defined in the research's framework. By analyzing these factors in few customer segments aim is both to confirm existing research findings and to further specify factors that affect adoption of new offerings of similar type. Focus is on understanding peculiarities of new offerings that link to high-level technological products and systems, which Case firm's new concept represents.

Case study's results are presented in the following subchapters factor by factor. Within the scope of each factor its underlying elements are analyzed individually and a conclusion on factor's effect to Case firm's new offering is drawn based on these analyses. An efficient launch decision -factor will be assessed based on both limited empirical findings and existing theoretical insights, while other factors' assessments are solely based on empirical evidence. As scarce quantitative data is available, analysis is mainly qualitative in nature. Whenever relevant, results are presented according to different customer segments. Main bases for customer segmentation are industry categorization and unit size as they are clear and applicable measures.

Implications of research findings to the whole research framework and its factors are discussed in a separate subchapter. Central themes in this subchapter are observed links between general factors, identified additional underlying elements and possible re-definitions of existing underlying elements. This discussion is carried out in a separate subchapter as it incorporates empirical findings from all of the factors.

4.3. RELATIVE ADVANTAGE OF CASE FIRM'S NEW OFFERING

Factor	Underlying elements
Relative advantage	Benefits of a new offering vs. Benefits of comparable solutions Costs of a new offering vs. Costs of comparable solutions

Relative advantage - factor is analyzed through two of its underlying elements, that is relative costs and relative benefits. Relative costs of Case firm's new concept are analyzed with a general cost comparison and its relative benefits are assessed in few potential applications that were identified in the customer interviews. More general findings, that is

cost comparisons, are presented first. Following these assessments is a conclusion on relative advantage –factor in this case.

Relative costs of an innovation are to be compared not only to its direct competitors but also to other available solutions, to which customers may compare it to (Guiltinan, 1999 and Kim and Mauborgne, 2005). This is why potential solutions a customer may compare the new concept are to be identified first. In Table 8 frequency of time-based maintenance and existing condition monitoring approaches in the sample are shown. Of the three condition monitoring approaches manual condition monitoring measurements is the most common approach in the sample. All interviewed customers stated to apply a time-based maintenance in their facilities, that is maintenance measures are undertaken over certain time intervals to ensure functionality of the equipment. As customers perceive time-based maintenance though differently these approaches may vary in the degree of their finesse.

Table 8. Interviewed firms applying time-based maintenance and different condition monitoring approaches in each industry (Customer interviews)

Industry	N	Time-based maintenance	Manual measurements	Individual condition monitoring solutions	Condition monitoring system
A	6	6	-	-	-
B	16	16	12	3	2
C	2	2	1	-	-
D	1	1	1	1	-
TOTAL	25	25	14	4	2

According to Case firm's technical expert the new concept has a clear cost advantage over condition monitoring systems when a low amount of devices are monitored (Case firm's technical expert). This is why further cost comparisons with monitoring systems are not carried out. In addition, as new concept represents at least at the moment a unique mixture of product and service components in the market, it is not directly comparable with other individual condition monitoring solutions. Because of these reasons new concept's costs are only compared to those of manual condition monitoring measurements. It is a logical point of reference as it is the most common condition monitoring approach in the sample.

Figure 20 shows a comparison of monthly monitoring costs per device between the new concept and a hired full-time employee, whose sole occupation is conducting condition monitoring in a firm. Monthly cost of monitoring a certain amount of devices with the new concept is calculated using Case firm's pricing tool, while monthly cost of an employee, who is equipped and trained appropriately, is calculated according to the following equation:

[Monthly costs of a full-time employee] = [Monthly salary x Wage-cost factor] + ([Investment costs to equipment & software] – [Depreciation]) / (12 x [Measurement device's lifetime in years]) + [Yearly training costs] / 12

If investment costs to equipment & software and depreciations are calculated as net present values, the whole cost estimate changes insignificantly. This is why net present value calculations are not included in the equation. Necessary cost information for the calculations was specified by Case firm's technical expert in the conducted interview. Key assumptions that apply to both calculations are that measurement devices are assumed to last 10 years and no management or co-ordination costs of monitoring are included. Key assumptions applied in calculating new concept's costs are that measured devices are in close vicinity of

each other, thus allowing full usage of monitoring units and travel costs to site consist only of limited travelling.

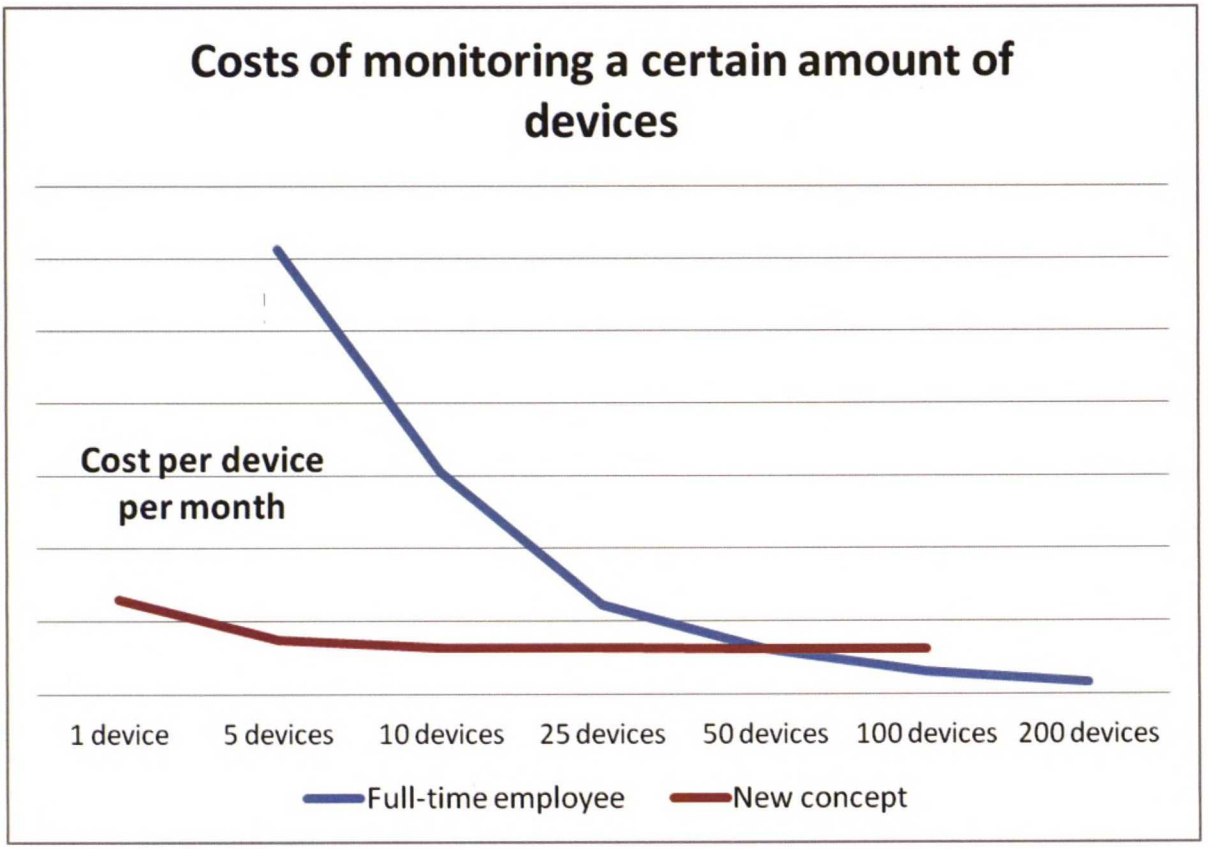


Figure 20. Representation of monthly condition monitoring costs per device for the new concept and for a full-time employee conducting the task

As comparison of monthly monitoring costs per device indicates, the new concept has a cost advantage compared to recruiting a full-time employee for the task in units, where condition of fewer than 50 devices is monitored. Further analysis should thus concentrate to units where 50 or fewer devices are monitored.

In units where 50 or fewer devices are monitored cost comparison versus a full-time employee does not represent reality. In Table 9 measurement cycles of firms conducting manual condition monitoring measurements are presented. As is shown, interviewed firms carry out condition monitoring measurements to their devices at the fastest pace once a month. This is why only in units with a high quantity of devices hiring a full-time employee to conduct solely this task is justifiable. Two customer interviews in units with a high quantity of devices reinforce this view as they have personnel conducting solely condition monitoring as their task (Customer interviews 16 and 22). In other interviewed units such personnel could not be identified (Customer interviews).

Table 9. Frequency of manual condition monitoring measurements in the firms applying it (Customer interviews)

Frequency of measurements	Once a week	Once every two weeks	Once a month	Once every two months	Once every half-a-year	Once a year
Number of organizations	0	0	4	6	3	1

Cost comparison representing reality has thus to be made against an employee, who conducts condition monitoring along other tasks. In addition, customers have a choice of hiring an external provider to carry out manual condition monitoring measurements for them. Costs of organizing condition monitoring with the new concept are compared to costs of these two approaches in Figure 21. 1-20 devices is specified as the size of the unit as it represents units where new concept is most cost-competitive. Monthly costs of an external condition monitoring provider are calculated based on an hourly rate specified by Case firm's technical expert. Other calculations are carried out following same equations and approaches as in the previous case. Key assumption that applies to all of these calculations is that no management or co-ordination costs of monitoring are included. Key assumptions applied in calculating monthly cost of an employee hired for this task are that condition monitoring of 20 devices requires 8 hours of total work and as employee has to switch tasks 25 % of his working time is spent idle. An external provider is assumed to require the same amount of working hours for the task as an internal worker.

Despite of analyzing units where the new concept is most cost competitive, applying it to a whole unit would lead to significantly higher costs than with prevailing manual condition monitoring approaches. From purely a cost-perspective the new concept does not thus offer an advantage. New concept's benefits are though different from manual condition monitoring measurements as it offers continuous condition information on devices. As continuous condition information on certain devices is desirable, for example because of their criticality to production process or because their breakdowns could lead to hazardous situations, customers may consider required additional investments to be worthwhile. From an analysis perspective condition monitoring of individual devices is a different proposition than one reviewed as condition monitoring of few critical devices will incur additional costs on top of existing condition monitoring costs. Key question then is whether incremental benefits justify incurred additional costs.

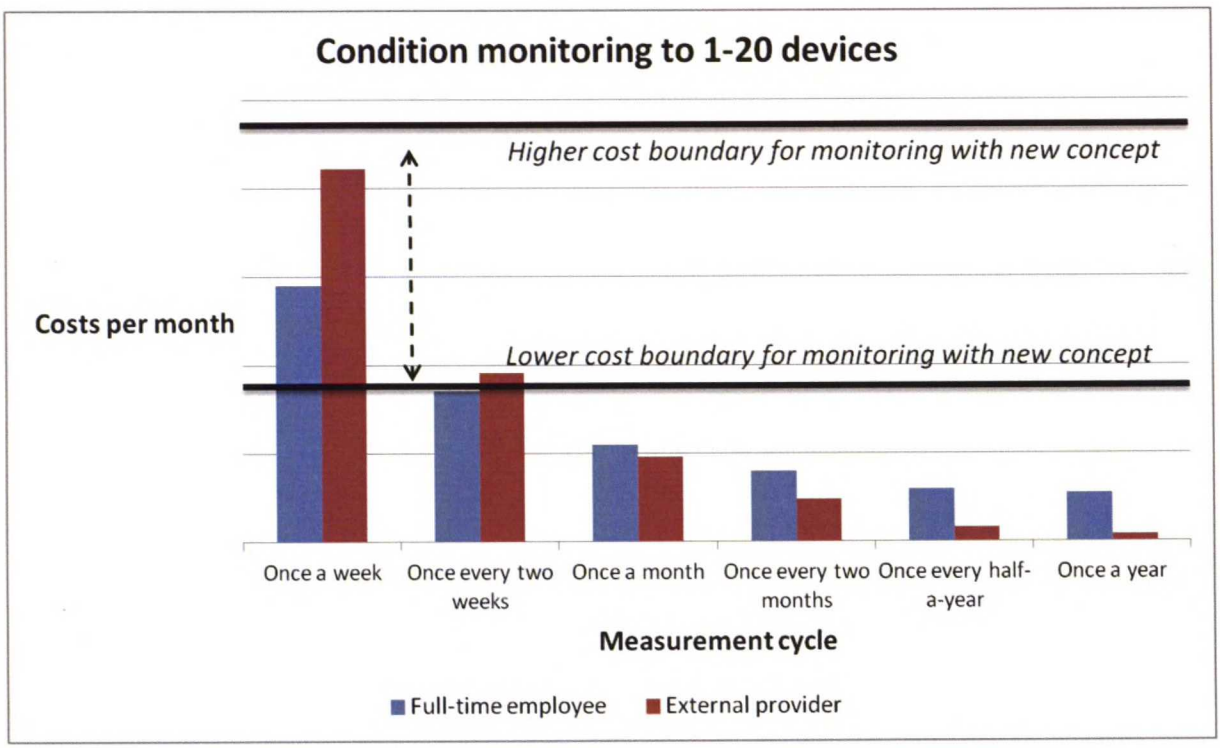


Figure 21. Representation of monthly condition monitoring costs to 1-20 devices through different approaches

Besides comparing costs of the new concept to various condition monitoring approaches, customers may compare its costs to a maintenance strategy of replacing a defect device

with a new one in case of a malfunction. In Figure 22 is shown how many years of condition monitoring with the new concept may be acquired with investment costs of various high-efficiency electrical motors. Prices of high-efficiency electrical motors were obtained from Case firm's internal material.

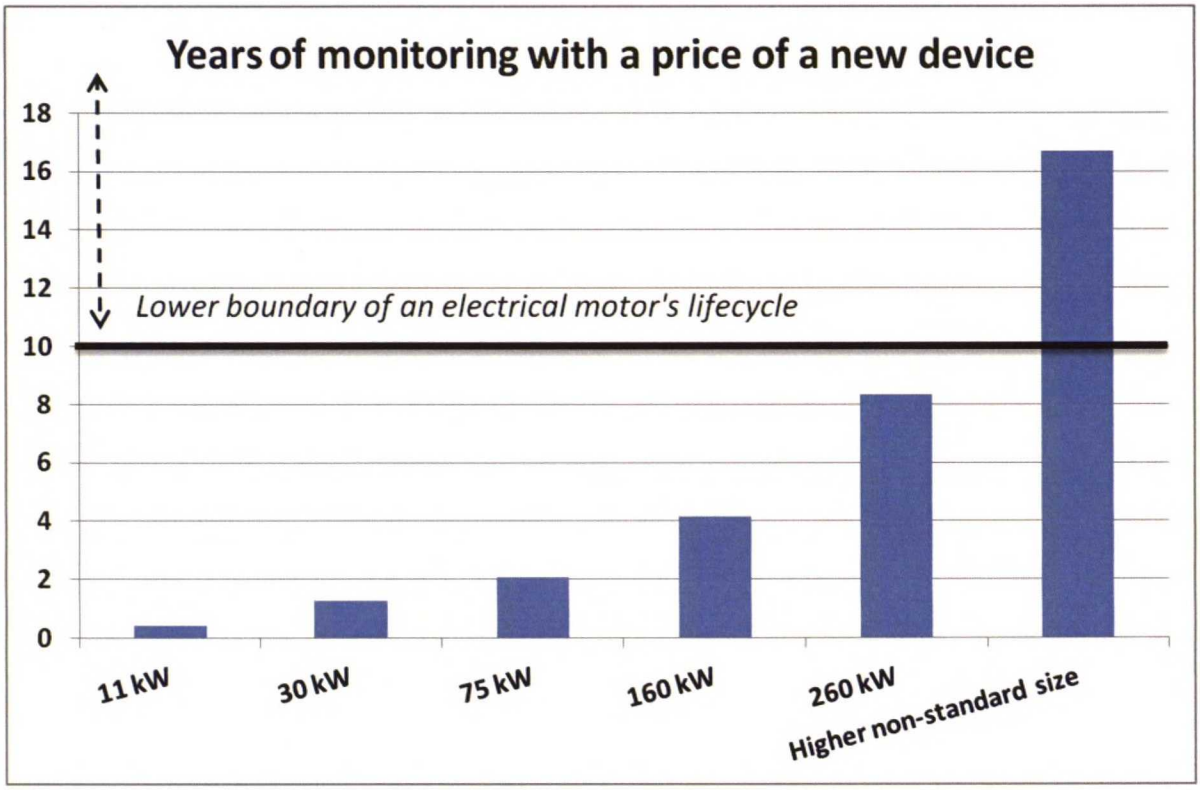


Figure 22. Investment costs of different size electrical motors as years of monitoring with the new concept

As an electrical motor operating in normal conditions has a lifecycle of at least 10 years (Case firm's technical expert), condition monitoring costs surpass investment costs of smaller devices several times over their lifecycle. This is why with smaller devices investing into a back-up device is generally a more cost-effective option than condition monitoring to ensure system's reliability. Customer interviews reinforce this view as customers have with smaller devices either invested into spare devices to enable quick maintenance measures or they have applied doubling, in which back-up devices are readily installed into a system to ensure its reliability (Customer interviews 9-12, 17-23). As acquiring a second device is a cost-effective and reliable solution with smaller devices to ensure system's reliability, potential devices benefiting from the new concept reduce in numbers extensively. This is because smaller devices are more common than larger ones (Customer interviews).

Analysis of new concept's relative costs indicates that is a more expensive solution than manual condition monitoring measurements. This is why solely from a cost-perspective it is applicable only to devices, to which manual condition monitoring measurements are inadequate. A key group would thus be devices whose condition has to be constantly monitored to ensure a system's reliability. Typically smaller devices are not included in this group as acquiring a back-up device represents a cost-effective option to ensure a system's functionality. As the new concept does not offer a clear cost advantage over existing solutions, its competitive price-to-performance ratio relies on additional benefits it is able to deliver. Understanding these additional benefits is also central in assessing whether new concept's incremental benefits are sufficient to justify required additional investments.

Measurable benefits of condition monitoring and of the new concept are based on preventing unexpected defects of devices. As condition of devices is known more precisely, required maintenance measures may be conducted before devices break down and incur additional costs. Condition monitoring is thus additional investment aimed to reduce overall maintenance costs. Three general cost elements whose sum determines maintenance costs of a system are shown in Figure 23.

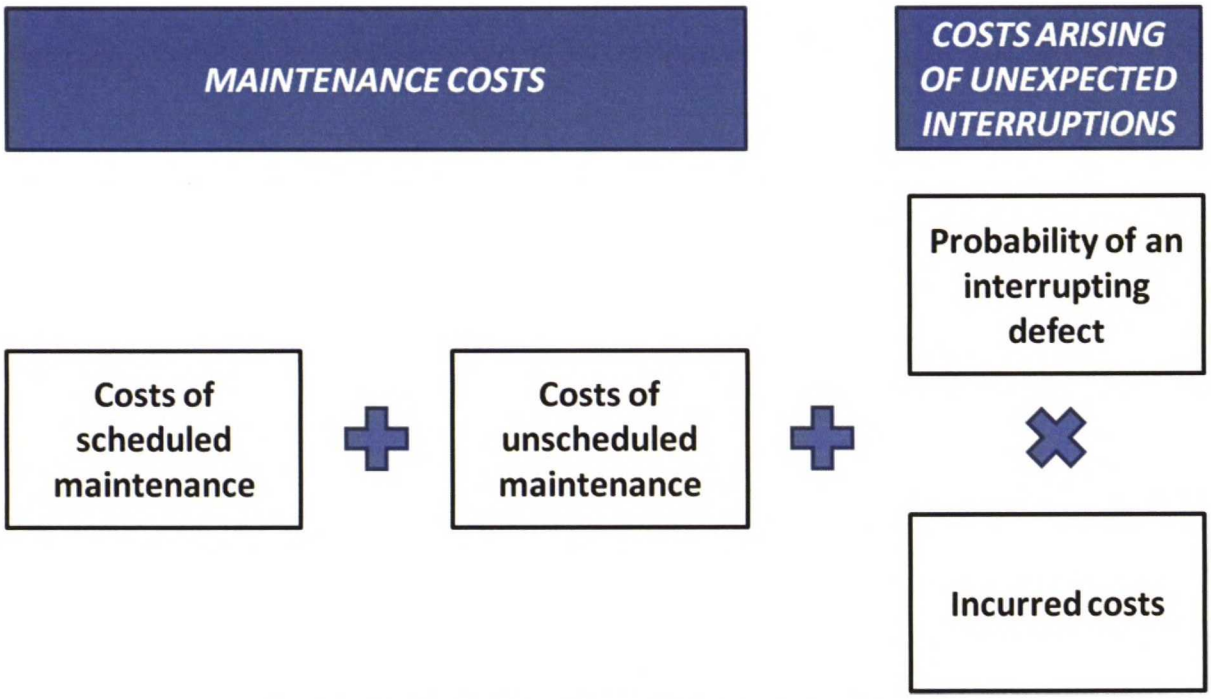


Figure 23. Main cost elements of maintenance costs

Through introducing an applicable solution one is able to significantly reduce costs arising of unexpected interruptions and to minimize the amount of unscheduled maintenance work, which typically is an order of magnitude more expensive than scheduled maintenance work (Lee et al., 2006). Acquiring the new concept to monitor critical devices is one applicable approach to this end. Various other approaches aiming to minimize these cost elements have though already been implemented. This is why new concept's benefits have to be assessed in relation to that of an existing solution. A key question is thus how much new concept is able to reduce costs of unexpected interruptions and of unscheduled maintenance further versus existing solution. Table 10 summarizes this type of assessments of potential applications, which were identified in the customer interviews. As detailed cost information could not be obtained, assessments have been derived from customers' own descriptions of their systems. Applied scale ranges from none through low to high.

Table 10. New concept's potential for further cost minimization in identified applications (Customer interviews)

lication	Prevailing existing solution	Probability of an interrupting defect	Costs of unscheduled maintenance	Overall potential for further minimization of maintenance costs
itical ps and kers in ustry B	Doubling of devices *(Customer interviews 9-12, 18, 22)*	No improvement with the new concept	No improvement with the new concept	**None**
d cranes dustry C	Condition monitoring measurements and crane monitoring systems in newer devices *(Customer interviews 6, 24)*	Low improvement with the new concept in units without existing monitoring systems	Low improvement with the new concept in units without existing monitoring systems	**None / Low**
pressors and trifuges dustry B	Monitoring as a safety measure *(Customer interviews 16-18, 22)*	No improvement with the new concept	Low improvement with the new concept; customization required	**None / Low**
ge mills nixers in ustry B	Condition monitoring measurements *(Customer interviews 13, 15, 18, 21)*	Low improvement with the new concept; customization required	Low improvement with the new concept; customization required	**None / Low**
arge wers in stries A nd B	Intensified time-based maintenance *(Customer interviews 7, 14, 19)*	Low improvement with the new concept	Low improvement with the new concept	**Low**
ctrical tors in stries A nd B	Additional capacity to partly handle unexpected interruptions *(Customer interviews 2, 3, 5, 8, 19)*	Low improvement with the new concept	Low improvement with the new concept	**Low**

Made assessments indicate that generally the new concept does not offer clear advantages over prevailing existing solutions. In the first two applications the new concept does not offer potential for further minimization of maintenance costs. This is because with specified devices customers have typically implemented doubling or they have acquired them with an existing monitoring system in place. In third and fourth applications the new concept has potential to further minimize maintenance costs, though not in its current form. Further customization of the new concept is required for it to fulfill necessary precision and compatibility requirements for these applications. In the last two applications implementing the new concept provides limited potential for further maintenance cost minimization as existing approaches rely only to intensive time-based maintenance or to partial doubling of devices.

When doubling has not been implemented and no condition monitoring system is installed, interviewed organizations rely either on manual condition monitoring measurements, on limited spare capacity, on basic time-based maintenance or on a combination of these to minimize unexpected system interruptions (Customer interviews). Typically new concept is

able to reduce probability of an interrupting defect and costs of unscheduled maintenance in these cases further. Whether these improvements turn correspondingly into added value on a system-level is though challenging to assess. One example of this is devices, which are not immediately critical to a system's functionality. With these types of devices a reliability-level which is below 100 % is adequate to ensure production system's continuous functionality. This is why improvements beyond certain level may not realize as additional benefits on a system-level (Customer interviews 7 and 14). Other concrete example is production units with built-in spare capacities. Improvements in condition monitoring of certain devices may be unnecessary as limited spare capacity is designed to offset majority of system interruptions (Customer interviews 5, 6 and 8). One additional example is units which due to demand conditions or due to nature of their end-product hold sizable storages. As these storages mitigate effects of limited production interruptions, benefits of more accurate condition monitoring may not realize on a system-level (Customer interviews 11, 18, 21).

Described examples represent cases where incremental improvements in certain part of a system do not necessarily add value to the whole system. These observations portray systemic nature of the new concept. In academic research systemic innovations have been identified to face the challenge that improvements they provide may be negated by system's limitations or bottlenecks (Tidd and Bessant, 2009, Chapter 9). As Table 11 indicates new concept's benefits, that is savings in maintenance costs, are uncertain on a system-level in majority of applications, where initial potential may be identified. Case study's findings coincide with existing research views on systemic innovation's benefits having a risk of not realizing on a system-level.

Table 11. Uncertainty of system-level benefits of the new concept in potential applications (Customer interviews)

Existing solution	References	Number of potential applications	Of which with uncertain system-level benefits
Manual condition monitoring measurements	*Customer interviews 6, 16, 18 and 24*	4	2
Limited spare capacity	*Customer interviews 2, 3, 5, 8, 14, 17 and 19*	7	7
Sole time-based maintenance	*Customer interviews 7, 18, 20a and 20b, 21*	5	5

Considering that the new concept offers only limited potential for further minimization of maintenance costs and it is uncertain whether these benefits realize on a system-level, incentive for organizations to change their existing solution is low. In comparison to existing offerings relative benefits of the new concept are thus low. In certain specific device categories additional benefits offered by the new concept may though be valued as continuous monitoring of certain devices is desirable. This requires though that no comparable solution has been implemented earlier.

Assessment of the relative cost indicates that the new concept is a more expensive solution than prevailing condition monitoring approaches. On the other hand, assessment of the relative benefits indicates that the new concept offers limited additional benefits in comparison to existing approaches. Combined these two imply that relative advantage of the new concept is low. Implication of this is that trial and adoption of the new concept is presumably slow, if it takes place at all. Additional factor slowing down adoption is the fact that there is only a limited quantity of large-size devices to which new concept is a rational solution for. As relative advantage is a customer-specific factor, findings on it hold directly only in researched industries. Due to similarities of devices in different industries findings assumedly have though a wider applicability within Finland.

Noteworthy of the made assessments is that they represent an analytical view on relative costs and benefits. Trial and adoption in a market is though determined by customers' perceptions of these (Guiltinan, 1999). As Case firm's representatives believe that maintenance organizations build their systems and processes with a high cost understanding (Workshop), these analyses are assumed to represent customers' perceptions to a large extent. In the scope of this research this may though not be confirmed.

Relative advantage as a factor influencing trial and adoption is defined in a clear and comprehensive manner to consist of relative benefits and relative costs. No additional underlying elements to the factor may be thus defined. Made analysis though indicates that relative benefits have to be assessed on two levels with offerings that link to complex products and systems. First assessment is to understand whether new offering is able to provide incremental benefits in certain part of a system. Second assessment is to analyze whether these benefits realize correspondingly on a system-level. Conducting sole first assessment is not adequate as benefits an offering generates in a part of system may not improve performance on a system-level. As system-level benefits depend on an offering's fit to existing system architecture, it is evident that relative advantage and compatibility factors of the research framework are linked to an extent. In addition, uncertainty regarding system-level benefits reflects to risks customers perceive to relate to an offering. This implies that at least in the studied case relative advantage has implications to risk barrier -factor. This indicates that factors influencing trial and adoption are linked to an extent and may even overlap in certain areas.

4.4. COMPATIBILITY OF CASE FIRM'S NEW OFFERING

Factor	Underlying elements
Compatibility	**... in terms of technology** - Existing system architecture - Existing equipment **... in terms of usage** - Existing processes - Existing skills and knowledge of customer's organization - Existing values and norms

4.4.1. TECHNOLOGICAL FIT OF THE NEW CONCEPT

Compatibility-factor is determined by offering's technological fit and usage fit. Owing to qualitative nature of these underlying elements precise conclusions on them and respectively on the whole factor may not be formed. Taking this restriction into account findings obtained in the customer interviews are assessed qualitatively. Assessment

progresses from technological to usage fit and ends to an indicative conclusion on whole factor's effect on trial and adoption of the new concept.

The new concept is a stand-alone system, in which condition monitoring measurements are supported by an external analysis service to produce advanced condition monitoring to individual devices. In a simplistic perspective its technological fit is a result of an analysis on whether its installation method and measurement technology are applicable to a particular device. In a wider perspective its technological fit constitutes though of further elements. From the existing academic research offering's fit to system architecture and possible technical switching costs may be identified as relevant additional elements to assess (Chiesa and Frattini, 2011). These and possible additional elements will be analyzed in the following to understand technological fit of the new concept comprehensively.

New concept's installation method and measurement technology are applicable to most device categories (Customer interviews). Few device categories, where the new concept is not applicable, do though stand out. A minor this type of group is devices, whose condition cannot be monitored with the new concept's measurement technology (Customer interviews 13 and 15). A more significant group is devices, whose condition monitoring solution has to contain a malfunction shutdown -functionality, which the new concept in its existing configuration does not have. With malfunction shutdown -functionality a device is shut down in case its operating conditions deviate significantly from set limits. This functionality is relevant for devices, whose unexpected breakdown could damage the surrounding system or cause a dangerous situation to the surrounding environment. Devices of this category are a potential target market for monitoring solutions as risks relating to them justify monitoring investments. In case study's sample 11-16 devices requiring malfunction shutdown -functionality were identified (Customer interviews 12, 13, 17, 18 and 22). Considering that approximately 75 potential devices were identified in total in the customer interviews (Customer interviews) they represent 14 % - 21 % of the observed market. As these observations indicate the new concept is not technologically fit to serve a notable part of the market with a logical need for condition monitoring. A potential device is defined in the previous figures as one that installing continuous condition monitoring solution to it has potential of being commercially justifiable. Because customer interviews were not exact technical reviews of customers' facilities, amount of potential devices is partly an estimate. This is why percentages calculated based on it have to be considered as estimates as well.

As the new concept is a stand-alone system only connections it is designed to have are to the device it measures and to the electricity network. Devices, to which it is an applicable solution to, are though typically connected with several links to the system they are part of. Most elementary connections are input and output -flows and physical links, while more advanced ones relate to shared automation, production control and condition monitoring systems. In 20 out of 25 interviewed units majority of potential devices are connected either to a production control or to a monitoring system (Customer interviews). Owing to its configuration the new concept does not build on top of existing systems, but represents a parallel solution. This approach hinders trial and adoption of the new concept in certain units. From the identified 20 production control or monitoring systems 5 contain condition monitoring functionalities similar to those of the new concept. As the new concept would lead to two parallel systems and thus to additional complexity, it is at disadvantageous solution compared to developing existing condition monitoring system further. In addition, analysis of measurement data, which is a part of the new concept's offering, does not benefit respective organizations in a clear manner as they have developed their own analysis capabilities while operating a condition monitoring system (Customer interviews 13, 16, 17, 22 and 23).

Other unfavorable configuration for the new concept are advanced systems, which control or monitor majority of sub-systems in a single production process to enable a high level of precision and performance. 11 systems out of identified 20 represent this type of advanced

integration of devices and systems. As system architecture is based on one single system, which enables efficient co-ordination of different parts of the process and into which all necessary functionalities are built-into, acquiring a parallel system such as the new concept to it is an unlikely solution. From a technical perspective maintaining a single system is a possibility as similar condition monitoring solutions than the new concept are available as add-ons to these advanced systems (Customer interviews 2, 3, 5, 6, 13, 16, 17, 19, 22, 23 and 24).

Table 12. Frequency of unfavourable systems in case study's industries (Customer interviews)

Industry	N	Units in which a system controls or monitors potential devices	Systems with condition monitoring functionalities	Systems with advanced integration of systems and devices	Total of unfavorable systems to the new concept
A	6	4	0	4	4
B	16	13	4	4	4
C	2	2	0	2	2
D	1	1	1	1	1
TOTAL	25	20	5	11	11

In Table 12 frequency of these unfavourable systems in sample's industries is shown. A total of 11 units thus contain a production control or monitoring system, whose attributes and design approach cause the new concept to be an unlikely solution to be acquired alongside it. Advanced integration of systems and devices is the main factor causing a unit's system to be unfavorable for the new concept (Customer interviews 2, 3, 5, 6, 13, 16, 17, 19, 22, 23 and 24).

The device configuration of a production process is along with production control and monitoring systems a defining part of a unit's system architecture. As new concept's installation is flexible to conduct, chosen layout does not affect new concept's fit to existing equipment. In several units structural solutions have been though implemented to ensure production systems' reliability (Customer interviews). With structural solutions production process's functionality is secured by implementing back-up solutions to applicable devices. As unexpected interruptions of backed-up devices do not endanger production system's functionality, cost-optimal solution is to reduce their condition monitoring. This approach for ensuring production systems' reliability is a fundamentally different one than that of the new concept and this is why the new concept faces challenges in fitting into these system architectures.

Table 13. Frequencies of identified structural solutions to ensure production systems' reliability in case study's industries (Customer interviews)

Industry	N	# units with limited spare capacity	# of units with doubling of devices	Total # of units with structural solutions for ensuring reliability
A	6	6	0	6
B	16	8	4	12
C	2	2	0	2
D	1	0	0	0
TOTAL	25	16	4	20

Table 13 shows frequencies of different structural solutions to ensure production process's reliability in the sample. In units, where production process's reliability has been ensured with limited spare capacity, parallel production systems are able to substitute each other's

operation over a limited period of time. As parallel systems consist of several interconnected devices this type of structural solution lowers reliability requirements of multiple devices (Customer interviews). Doubling of devices, that is installation of back-up devices readily into a system, affects on the other hand reliability requirements of only specific devices it is applied to. In three out of four sample's cases doubling has been applied only to selected devices in a unit while in one case majority of devices have a back-up solution in place (Customer interviews 11, 12, 17 and 18). Structural solutions are thus applied to a varying extent of unit's devices and typically a certain proportion of unit's devices remain outside them.

Interviewed organizations do not perceive the new concept to contribute additional benefits along an implemented structural solution. In industries A and C installed limited spare capacity is able to compensate missing production temporarily and this is why interviewed organizations do not see additional value in minimizing unexpected interruptions further through the new concept (Customer interviews 1-6, 19 and 24). In industry B structural solutions typically limit to certain parts of a production process. Interviewed organizations perceive reliability of these parts of their process to be of high-level, which is why additional investments required to implement the new concept are not believed to pay off in these parts of the process (Customer interviews 8-18 and 22). Even though these perceptions are disputable, especially in units where production process's reliability has been ensured with limited spare capacity, their implication is that the new concept is perceived to be inapplicable to system architectures with structural solutions. In units with limited spare capacity low fit extends to multiple devices, while in units where doubling has been applied low fit limits to individual devices. Even though structural solutions do not extend to every device in a unit, their effects on commercial potential of the new concept are significant. This is because structural solutions are typically applied to most critical devices, which also represent potential devices for the new concept. Financial rationale of installing any condition monitoring solution to remaining less critical devices is typically questionable as additional commercial benefits achieved through increased reliability are limited or difficult to concretize (Customer interviews).

Few units where no structural solutions to ensure production process's reliability have been implemented are present in the case study's sample First category of them is units, which contain that expensive of a equipment that doubling or installing limited spare capacity is commercially not a viable option (Customer interviews 13 and 23). Second category of them is units, which operate a continuous production process without intermediate storages. As functionality of every component and device is in these units equally critical to the production process, comprehensive structural solution would be required to ensure production process's reliability. As investments to implement a comprehensive structural solution are extensive, units choose not to pursue it (Customer interviews 20a and 20b). One unit in the sample forms an exception as all of its devices have been doubled to reach one hundred per cent reliability in terms of the whole system (Customer interview 11). Third category of units where no structural solutions have been implemented is units, where different parts of the production system operate individually without constant links to other parts of the system. These systems contain intermediate storages which ensure that majority of the production system is able to operate even though parts of it would face unexpected production interruptions. Intermediate storages thus serve the function of ensuring production process's reliability (Customer interviews 6, 21 and 24). Based on attributes of these three categories most potential units for the new concept are ones with expensive equipment, with a continuous production process and without significant intermediate storages.

As solutions to ensure production process's reliability are in place in majority of units (Customer interviews), technical switching costs from the existing solution to the new concept may affect organizations' adoption decisions. As the new concept may be installed as a parallel system to the existing one, no additional technical switching costs arise in this

type of an installation. Disadvantage of this approach is that it leads to parallel solutions for ensuring production process's reliability, both of which incur costs to an organization. Installing the new concept as a parallel solution is plausible with devices, whose reliability has been ensured with a structural solution, and within units, which apply solely manual condition monitoring measurements, as it enables continuous condition monitoring as an additional feature. In units with existing production control and monitoring systems parallel installation of the new concept is more difficult to justify as similar features than it offers may be integrated into the existing system. This point is reflected in qualitative data as organizations with advanced integration of systems and devices stated a strong interest to integrate the new concept into their existing systems and as organizations with an existing condition monitoring system required integration of the new concept into their existing systems. As technical costs of integration are significant, both of these groups considered the new concept an inapplicable condition monitoring solution to their needs (Customer interviews 2, 3, 5, 6, 13, 16, 17, 19, 22, 23 and 24).

Technical switching costs from an existing condition monitoring solution to the new concept do not thus differ from standard installation costs as long as wider system integration is not required. If this is a requirement, technical switching costs become significant (Customer interviews). The new concept thus faces a significant barrier for trial and adoption in units with an existing production control or monitoring system, which respectively affects negatively technological fit of the new concept. This observation is in line with existing research findings on challenges that innovations linking to complex products and systems face. With these types of innovations costs arising of required system changes may exceed achievable commercial benefits, which hinder their trial and adoption (Tidd and Bessant, 2009, Chapter 9).

Research framework defines technological fit to consist of an offering's fit to existing equipment and to existing system architecture. Gathered qualitative data and conducted assessments based on it show these fits to be relevant ones for assessing an offering's compatibility. Besides these underlying elements gathered data does not indicate clear additional elements to influence technological fit of an offering that is a sub-system to a COPS. Case study though implies that different types of technical switching costs are significant in each element of technological fit. When new concept's fit to existing equipment is considered, technical switching costs consists of direct costs of changing an existing solution to the new concept. When new concept's fit to existing system architecture is considered, technical switching costs are dominated by costs of integrating the new concept to the existing system (Customer interviews). This is driven by the fact that the new concept is a sub-system to a wider whole, which is why its adaptation to the existing structure is more justifiable than modifying the existing structure. Technical switching costs thus have to be considered both in terms of direct costs of changing an existing solution to a new offering and in terms of integrating a new offering to an existing system architecture. Both of these dimensions may pose a barrier for trial and adoption of a new offering.

To bring gathered evidence to a single assessment it may be stated that the new concept's fit to existing equipment is moderate and its fit to existing system architecture is low. With equal weights these two imply technological fit of the new concept to be low. The new concept's fit to existing equipment is assessed as moderate, because its installation method and measurement technology are applicable to most devices, but in its current configuration it is missing malfunction shutdown -functionality which makes it an inapplicable solution to a notable part of the market. The new concept's fit to existing system architecture is assessed as low as new concept's integration to widespread production control and monitoring systems is expensive and as reliability has been in several occasions been ensured with structural solutions along which the new concept offers only limited added value. Additional challenge arising of widespread existing solutions and new concept's incompatibility to them

is that typically solutions have been applied to most critical devices, thus leaving only less critical devices as a remaining opportunity.

4.4.2. USAGE FIT OF THE NEW CONCEPT

Usage fit represents non-technological aspects of compatibility as one element. According to the research framework, which bases on the existing research, following three fits underlie it: offering's fit to customer's existing processes (Rogers, 2003), offering's fit to skills and knowledge of customer's organization (Guiltinan, 1999) and offering's fit to values and norms of customer's organization (Rogers, 2003). These and possible additional aspects will be analyzed in the following to understand usage fit of the new concept comprehensively.

According to Rogers (2003) the more an innovation requires changes in customer's existing processes, the less compatible it is. As indicated in the discussion on relative advantage all interviewed organizations are carrying out time-based maintenance approach and majority of units, where investments to condition monitoring are justifiable, conduct manual condition monitoring measurements (Customer interviews). Table 14 extends Table 8 with information on whether interviewed organizations carry out manual condition monitoring measurements with own resources, by contracting an external provider to conduct them or with a combination of these two.

Table 14. Interviewed organizations applying time-based maintenance and conducting manual condition monitoring measurements with own resources or by contracting an external provider (Customer interviews)

Industry	N	Time-based maintenance	Manual measurements	Own resources	External provider	Own resources supported by an external provider
A	6	6	-	-	-	-
B	16	16	12	3	6	3
C	2	2	1	1	-	-
D	1	1	1	-	1	-
TOTAL	25	25	14	4	7	3

Contracting an external provider to conduct condition monitoring measurements is a typical approach in the sample. Offerings of external providers and how they link to customers' processes differ though significantly from the new concept. In majority of cases external providers conduct manual condition monitoring measurements to customers' devices every 2 to 12 months to identify potential defects in devices which have not been identified in the time-based maintenance approach (Customer interviews 8-13, 15, 17, 18 and 23). Manual condition monitoring measurements thus support time-based maintenance activities by providing infrequent condition monitoring assessment of customers' devices. With the new concept customer would receive online condition monitoring information from selected devices and it would be assisted to understand rationales of significant deviations in the measurement data. Required maintenance actions would be defined based on these on-going assessments (Case firm's technical expert). From a process perspective two major differences set apart existing use of external providers and proposed process of the new concept. First major difference is that with the new concept infrequent thorough analysis of condition monitoring measurements would change to a continuous flow of condition information which would be analyzed when significant deviations or trends are observed. Devoted and qualified resources either from customer, external provider or both would be required to provide constant vigilance of condition monitoring information. Second major difference is that with the new concept condition monitoring information is designed to have a leading role in defining required maintenance actions instead of supporting time-based maintenance approach. This would require respective re-design of the maintenance process.

In the basic offering of the new concept Case firm provides continuous monitoring of gathered measurement data. Even though customer is relieved of monitoring task it is expected to have resources in place to assist in analyzing root causes of observed deviations. In existing processes where external providers are contracted to conduct infrequent condition monitoring measurements participation from customers' side is minimal. This is why devoted resources to condition monitoring are not readily available (Customer interviews 8-13, 15, 17, 18 and 23). Implementing the new concept would require these resources to be defined. Besides on analysis of root causes, the new concept relies on local maintenance organization on carrying out defined maintenance actions. Because of these resource-needs new concept does not unbind resources of local maintenance organizations, but in comparison to existing use of external providers binds them increasingly to condition monitoring activities. Considering frequency of significant deviations in the measurement data required participation is not significant in terms of time. It though represents a process change both in terms of devoted resources and in terms of activities, which according to the logic of Rogers (2003) decreases new concept's fit to existing processes to an extent.

Second major difference is that organizations would have to consider how to organize their maintenance processes when continuous condition monitoring information on individual devices is available. Considering that condition monitoring information would be used to define required maintenance actions, role of scheduled maintenance check-ups and measures becomes unclear. Because the new concept is designed to be installed to individual devices and because some scheduled maintenance measures have to be carried out over certain intervals, for example lubrication of certain components (Customer interview 19), an organization cannot stop time-based maintenance measures altogether. In addition, three larger units stated that introducing the new concept to individual devices in their facility is not in their interest as they want their maintenance employees to inspect their facility and its devices and components comprehensively along scheduled maintenance check-ups (Customer interviews 10, 16 and 22). This exemplifies an activity that organizations consider valuable in existing maintenance process, which is not part of condition-based maintenance approach. Because of the mentioned benefits certain activities from existing time-based maintenance processes would remain even though the new concept would be implemented widely in a unit.

The new concept thus does not clearly remove existing tasks, but adds elements on top of existing processes. Neither Case firm nor interviewed organizations (Customer interviews) have a clear vision on what would be an efficient combination of time-based and condition monitoring -based maintenance approaches. This is left to be assessed in each case separately. Nonetheless, this unclear change in maintenance processes indicates how the new concept does not fit seamlessly to existing processes. In majority of cases the new concept would create at least partly parallel process, which would require limited participation from the customer's organization. Key question is then whether this parallel process is worth the benefits it is able to generate. Previous discussion reinforces that as an offering new concept's value creation logic is based more on creating added value to customers by adding something than on reducing costs for example by lowering headcount of local maintenance organizations.

According to Guiltinan (1999) new offering's fit to skills and knowledge of an organization is defined by how much it preserves and leverages existing skills and knowledge of an organization. If an organization has to acquire new skills or knowledge to gain from the new offering or if an organization's prior experience loses its value when the new offering is implemented, this fit is respectively reduced. To clarify existing skills and knowledge of interviewed organizations Table 15 classifies sample's units based on the size of their maintenance organization and provides information on commonness of different condition monitoring activities in each group.

Table 15. Different size maintenance organizations in the sample and commonness of condition monitoring activities in each size-group (Customer interviews)

Size of the maintenance organization	N	Personnel trained in condition-based maintenance	Manual measurements - Own	Manual measurements – External	Condition monitoring solutions or system
Large	4	2	2	1	3
Medium	10	3	1	3	1
Small	11	-	1	6	2
TOTAL	25	5	4	10	6

5 out of interviewed 25 organizations stated to have personnel trained in condition-based maintenance and its measures (Customer interviews 3, 16, 20a, 22 and 23). Most interviewed organizations do no thus have comprehensive understanding of condition monitoring activities. Larger organizations with their own condition monitoring systems are only identifiable group, which would lose value of their prior experience and existing skills, if they were to implement the new concept and consequently outsource monitoring of condition monitoring data (Customer interviews 16, 22 and 23). The new concept's low fit to existing skills and knowledge of larger organizations is besides technical issues one more aspect lowering their interest to adopt the concept.

With medium- and small-size maintenance organizations implementation of the new concept does not reduce the value of organization's prior experience and knowledge on condition monitoring as in majority of cases it is an outsourced activity (Customer interviews). In addition, assumption behind the new concept is that only limited skills are required from customer's organization as monitoring and analysis of measurement data are carried out by Case firm (Case firm's technical expert). This is why the new concept would offer to smaller organizations access to condition monitoring skills and knowledge with an adequate fit.

The basic offering of the new concept thus fits skill and knowledge -needs of small- and medium-size maintenance organizations better than those of large-size maintenance organizations. This exemplifies how a supplier faces buyers with different levels of own technical knowledge and how this reflects as varying needs and preferences. Existing research states that a provider should design separate offerings and sales process to customer groups' with different levels of technical knowledge (Kaario et al., 2003) Case firm's own experience is that customers with high level of technical knowledge typically do not benefit from provided services as they decide to carry them out themselves (Case firm's senior sales manager). It may thus be that the new concept is not feasible with organizations that have high level of own technical knowledge. This thematic will be elaborated further in the discussion on the appropriate launch factor for the new concept.

Explicit attributes of an offering's fit to values and norms of customer's organization are difficult to specify (Rogers, 2003). In the conducted interviews two themes relating to this fit arose though frequently: significance of criticality assessments to an organization and organization's perception on reliability of electrical motors. In Table 16 quantity of units that have conducted a criticality assessment and quantity of units that perceive electrical motors as highly reliable devices is shown.

Table 16. Frequency of interviewed organizations with conducted criticality assessments and with positive perceptions on electrical motors' reliability (Customer interviews)

Industry	N	Criticality assessment conducted in a unit	Electrical motors perceived highly reliable
A	6	-	4
B	16	11	3
C	2	1	2
D	1	1	-
TOTAL	25	13	9

When a unit conducts criticality assessment it defines how important each device's functionality is to its production process. Through this analysis an organization gains a clear view on where in its facility should it invest to ensure reliability of its production process. As these organizations are generally interested in optimizing their production system's reliability, offerings like the new concept are of interest to them. Some of these organizations have already reacted to the defects that were identified in their criticality assessment, which is why the new concept might not be relevant for them anymore. Nonetheless, from perspective of values and norms the new concept is a fitting offering to these organizations. As is shown criticality assessments have been widely conducted in industries, which promotes demand of offerings, which aim to optimize reliability of a device or of a system (Customer interviews 10, 12, 13, 15-18, 20-21, 23 and 24).

As the new concept is designed primarily to monitor different types of electrical motors, organization's perceptions on whether it is worthwhile activity affect their perception of the new concept. Approximately one third of the whole sample considers electrical motors to be highly reliable devices, which is why they have a critical opinion of investing into ensuring their reliability. Especially in industry A organizations state that their electrical motors have operated without significant interruptions for over 10 years (Customer interviews 1-3 and 5). Suspicion of interviewed organizations with highly reliable electrical motors is that their electrical motors are oversized to the task they are being used or scheduled maintenance measures defined by device manufacturers are overcautious (Customer interviews 1-3, 5, 6, 13, 14, 22 and 24). Understandably these organizations do not perceive condition monitoring to be a worthwhile activity as it would incur additional costs without significant additional benefits. This is why the new concept is an unfitting offering in terms of values and norms of these organizations. Case firm's view is that in a standard use an electrical motor will last for approximately 15 years and some kind of interruptions will certainly occur over its lifetime (Case firm's technical expert). There is thus an unresolved conflict between Case firm's and customers' views.

In the research framework usage fit has been defined to consists of an offering's fit to customer's existing processes, offering's fit to skills and knowledge of customer's organization and offering's fit to values and norms of customer's organization. No clear additional elements, which would significantly affect usage fit of an offering, arise from the gathered qualitative data. One topic which should be more in the research framework is whether resource-requirements of an offering fit available resources of an organization. This would be relevant as certain offerings are plausible to implement only after a unit is in size beyond a certain resource-threshold. For example, in research's case it is feasible only for larger organization to implement a condition monitoring system and hire own resources to operate it (Customer interviews). In addition, if an offering requires an organization to devote more or less resources to an activity it has an effect on organization's adoption decision. This is why a separate consideration should be made on offering's fit to resources to customer's organization. This may be included in the framework to the assessment on offering's fit to customer's existing processes.

Based on previous observations it may be stated that the new concept's fit to customers' existing processes is moderate, its fit to skills and knowledge of customers' organizations is moderate and its fit to values and norms of customers' organization is moderate. The new concept's fit to customers' existing processes is assessed as moderate because it does not fit seamlessly to existing processes, but in majority of cases creates at least partly a parallel process and binds resources of customer's organization in a limited manner. The new concept's fit to skills and knowledge of customers' organizations is assessed as moderate. This is because the new concept does not require small- and medium-size organizations to acquire new skills or knowledge to benefit from it, but it reduces the value of larger organization's prior experience and knowledge on condition monitoring. Narrow obtained evidence on the new concept's fit to values and norms of customers' organization indicates it to be moderate. On one hand most organizations have motivation to improve reliability of their production processes and to that end many of them have conducted criticality assessments. On the other hand several organizations perceive electrical motors to be highly reliable devices and thus perceive investments aimed to ensure their reliability as waste. With equal weight of each element usage fit of the new concept may be overall assessed as moderate.

4.4.3. CONCLUSION ON COMPATIBILITY-FACTOR

A number of elements combine into new concept's compatibility-factor. These elements are qualitative in nature, which is why clear and precise conclusions on them cannot be made. In addition, assumptions on their relative weights have to be made to combine them. Because of these reasons compatibility-factor may be assessed only directionally.

Gathered qualitative data enables one to identify effects underlying elements have on new offering's trial and adoption. Data does not though indicate relative significance of these underlying elements in customers' decision-making. Due to this technological and usage fits are assumed to have equal weights in customers' decision-making. As stated in the previous sub-chapters, elements underlying technological and usage fits were assumed to have equal significances to these fits as well. All underlying elements are thus assumed to have an equal significance on the higher-level factor they contribute to.

Overall technological fit of the new concept is low and usage fit of the new concept is moderate. Considering that overall low technological fit is a conservative assessment of positive and negative elements, compatibility-factor of the new concept may be assessed overall as moderate. As this directional statement indicates, in majority of cases the new concept does not fit directly to existing technologies and processes, but neither is it entirely unfitting. For different customer groups different individual elements of compatibility may have a decisive significance to their adoption decision. This is why key insights leading to this directional statement have to be acknowledged.

From technological perspective most significant negative finding is that new concept's fit to existing system architectures is low, because structural solutions for ensuring production system's reliability are widespread and because the new concept is expensive to integrate into existing production control and monitoring systems, which in sample's units were relatively common. From both technological and usage perspectives the new concept has a low fit to larger units, where own condition monitoring processes have been developed and at times even own condition monitoring system have been implemented. Losing the value of acquired condition monitoring know-how and having to invest into integration of the new concept into existing systems or processes hinder these units from adopting the new concept. Case firm's own experiences outside conducted case study confirm larger organizations not to be interested of the new concept due to specified reasons (Workshop). Several of the interviewed organizations perceive electrical motors to be highly reliable

devices and thus consider condition monitoring investments not to be worthwhile. These perceptions hinder adoption of condition monitoring -services, one of which the new concept is, and thus pose a barrier for trial and adoption of the new concept from usage perspective. Most significant positive findings based on the sample are that new concept's installation method and measurement technology are applicable to majority of intended devices, it fits and complements small- and medium-size organizations' existing skills on condition monitoring and most organizations value and understand the significance of reliability investments as they have conducted criticality assessments in their respective units.

Even though the new concept is designed as a parallel system in majority of cases it links to a complex product or system, whose functionality it aims to increase. This is why it cannot be analyzed as a stand-alone innovation, but has to be perceived as a systemic innovation, with which effects to surrounding system have to considered (Chiesa and Frattini, 2011). As analysis of compatibility-factor indicates, the new concept does not directly fit into existing system architectures and processes. This is why the new concept has either to be developed to fit to existing system architectures or adequate support has to be gathered from adoption network to change system architectures to more fitting ones for the new concept (Chiesa and Frattini, 2011). A defining analysis here is whether obtainable benefits justify costs arising of required system changes (Tidd and Bessant, 2009, Chapter 9). Considering results on the new concept's relative advantage, this will not be the case in several applications. An existing research finding is that as long as new offering's benefits are identifiable in certain applications, over time either targeted organizations, new offering or both adapt to reach a higher-level of compatibility to gain these (Tidd and Bessant, 2009, Chapter 8). By being able to concretize benefits of the new concept in certain applications, the amount of applications, where the new concept would be an applicable solution, could thus be increased over time.

As case study's sample consists of two industries with a representative sample and another two with few data points, assessment on compatibility-factor is based on a limited sample and thus is not generally applicable. As similar production control and monitoring systems; structural solutions for ensuring production process's reliability and devices are used in different industries drawn conclusions may have a wider applicability. Similarly as sample includes both small, medium and large-size organizations drawn conclusions may be based on a representative enough of a sample.

Through its underlying elements compatibility-factor includes a mixture of effects that affect trial and adoption of a new offering. Separating these effects into individual underlying elements for analysis is partially an artificial exercise as for example implemented technological solutions reflect to the process that a unit follows (Customer interviews). Similarly combining them with certain weights to an overall factor is an artificial exercise as in the end each organization carries out this assessment based on variables it considers important. This is why forming a general assessment on compatibility-factor based on proposed fits is challenging and at best inaccurate. Made decision in this research to redefine compatibility-factor to technological - and usage fit enabled detailed analysis as intended, but defined units of analysis are not entirely mutually exclusive and collectively exhaustive. This is why separate assessments of technological - and usage fit should be removed from the research framework and all identified effects should be analyzed together as one qualitative assessment. In this way more mutually exclusive and collectively exhaustive analysis of this qualitative factor is possible. As compatibility-factor is a mixture of a wealth of effects it has implications to risk and tradition barriers of the research framework. This is a second area, where factors influencing trial and adoption of a new offering are linked to an extent.

New offering's fit to existing system architecture was an individual element that was included to the research framework from complex products and systems -literature as a relevant point

of view for offerings that link to COPS. Several insights obtained by analyzing this individual element confirm it to be a relevant individual element to assess as part of compatibility-factor. No other clear additional individual elements to compatibility-factor are identified in the case study.

4.5. RISK BARRIER -FACTOR OF CASE FIRM'S NEW OFFERING

Factor	Underlying elements
Risk barrier	Uncertainties and potential unanticipated side effects Perceptions on complexity, trialability and observability

Risk barrier is a customer-specific factor, whose significance is determined by uncertainties that a customer perceives to relate to a new offering. These uncertainties stem from customer's own perceptions, but attributes of a new offering may enhance or reduce them. This is why customers' perceptions of complexity, trialability and observability of a new offering affect risk barrier -factor. Complexity of a new offering refers to how difficult to understand or to use customers perceive an offering (Rogers, 2003 and Tidd and Bessant, 2009, Chapter 8). Trialability of a new offering refers to degree to which a new offering may be experimented before a purchase decision (Tidd and Bessant, 2009, Chapter 8). Observability of a new offering refers to how visible benefits of a new offering are to others (Rogers, 2003 and Tidd and Bessant, 2009, Chapter 8). As these perceptions are challenging to research on, a comprehensive analysis on them cannot be presented. Through analysis of themes, which repeat in the gathered qualitative data, key aspects of new concept's risk barrier -factor may though be identified. Presented analysis will proceed from recurring themes in the gathered qualitative data to how customers perceive specified characteristics of the new concept.

Several interviewed organizations stated to be uncertain of additional benefits they were to gain if they were to implement the new concept (Customer interviews). This concern of interviewed organizations is comprehensible as the new concept delivers benefits in an indirect manner over unspecified time-periods, that is by avoiding costs arising of infrequent breakdowns of devices. In a non-constant environment these benefits are challenging to verify posterior. In addition, even though condition monitoring technologies are reliable to an extent, probability for an error exists. This is why a certain level of uncertainty is characteristic for the new concept.

In theory production systems' reliabilities have been optimized to a level, where marginal benefits and marginal costs of increased reliability are equal. Because of this optimization new concept's benefits limit to incremental reliability it is able to enable. If a production system's reliability is on a high-level, potential for incremental benefits is limited. In addition, if further increases in reliability require switching from an existing functioning solution to a new one, an organization is required to take a risk with a limited pay-off. Several interviewed organizations stated their production system's reliability to be of high-level and correspondingly considered incremental benefits of the new concept to be highly uncertain (Customer interviews 2, 3, 5, 10, 12, 14 and 24). These organizations do not thus perceive the new concept to be clearly a superior solution, which is why a risk barrier for its trial and adoption exists. Conducted analysis on relative advantage -factor supports organizations' views as in majority of potential applications new concept's benefits for the whole production system are uncertain (see Table 11 on page 70).

Besides general uncertainty on new concept's benefits, several organizations state precise uncertainties which they perceive to relate to the new concept. Few organizations question technological applicability of the new concept to potential devices in their units (Customer

interviews 6, 8, 18). Considering number of units and devices in the sample, these are limited concerns and reflect how broad technological applicability of the new concept is generally accepted by organizations. Technological applicability is thus not a significant source of uncertainty for customers. Organizations with experiences on condition monitoring measurements state both negative and positive opinions on them. Disappointing experiences have resulted from condition monitoring measurements, which have failed to identify defecting devices shortly before their breakdowns (Customer interviews 3, 9, 12, 15, 19, 20 and 22). According to maintenance manager of one unit, condition monitoring measurements become difficult to justify to an organization, if this repeats few times (Customer interview 22). This is why negative experiences and negative image they have created contribute negatively to trial and adoption of the new concept. Reputation of condition monitoring measurements is though two-fold as several interviewed organizations state positive experiences from them. Positive experiences originate from situations where organizations have been able to avoid unexpected interruptions of devices with condition monitoring measurements (Customer interviews 10, 11, 16, 17, 18 and 24). Organizations' experiences on condition monitoring measurements are thus mixed and cannot be precisely stated to negatively or positively affect new concept's risk barrier -factor. Considering individual units, ones with negative experiences undoubtedly perceive new concept's benefits to be more uncertain which results to a higher risk barrier -factor.

Organizations with own resources in condition monitoring activities doubt whether an external provider is able to conduct detailed enough analyses based on the measurement data the new concept provides. According to them monitoring of few specific signals is inadequate for pin-pointing relevant and non-relevant changes in devices. In their opinion a more comprehensive approach is required for that (Customer interviews 13, 16, 22). As these statements are made by organizations, which are experienced in condition monitoring measurements and perceive condition monitoring activities positively, their content bears significance to the new concept. New concept's approach of relying on few key measurements is thus considered at least by the experienced organizations uncertain. This respectively represents a risk barrier to at least these organizations.

If an organization has own experiences of an offering or is familiar of it in one form or another, an organization perceives fewer uncertainties to relate to it. Of the 25 interviewed organizations 12 were not familiar with a similar offering than the new concept (Customer interviews 1, 2, 4-6, 8, 9, 11, 14 and 20a-21). Additional 6 organizations were only aware of wider condition monitoring systems, which they did not consider directly applicable to their units (Customer interviews 3, 7, 10, 12, 17 and 18). This is why for approximately 75 % of the sample individual condition monitoring solution is a new type of an offering. Their perceptions of the new concept are uncertain thus also because of its newness. Uncertainties relating to a new offering may be reduced by introducing it in a convincing manner. Whether this is possible, depends though partly on the attributes of an offering. Interviewed organizations do not perceive the new concept to be a complex offering as it is understood on a general level (Customer interviews). Service side of new concept though raised several questions among interviewed organizations. This indicates that the new concept is not that observable of an offering and organizations are not certain for what kind of an activity they are requested to pay for (Customer interviews). As only few of the sample's organizations had an immediate interest to the new concept, interviewed organizations' perceptions on new concept's trialability could not be assessed. Implication of these perceptions to new concept's risk barrier -factor is that organizations on general level understand the new concept, but cannot that precisely observe what they are paying for. This is why a certain risk barrier arises of the attributes of the new concept itself.

Risk barrier -factor represents adoption barriers arising of uncertainties that customers perceive to relate to an offering. Per its definition it includes a wide-range of topics that different customers consider to be relevant. This is why it is a problematic element of the

research framework as it links and potentially overlaps with themes of relative advantage, compatibility and image barrier -factors. For research framework to be applicable in a scientific research its different elements would have to be mutually exclusive and collectively exhaustive.

One additional underlying element, which fits under risk barrier -factor in the research framework, is identified in the case study: organizations' experiences on a similar offering or on similar technology. These experiences predefine organizations' perceptions of a new offering and thus significantly impact uncertainties organizations perceive to relate to it (Customer interviews). This underlying element should be added besides already defined underlying elements to specify risk barrier -factor more in detail and to have an underlying element that concentrates on antecedents of existing perceptions. No specific implications to risk barrier -factor may be drawn based on that studied offering is a sub-system to a complex product or system. Already stated point of system-level considerations differing from considerations done to individual devices is relevant to risk barrier -factor, but it does not imply specific changes to the definition of risk barrier -factor, as it is widely defined unit of analysis and thus includes both unit- and system-level aspects readily.

Analysis of new concept's risk barrier -factor indicates mixed results. Risk barrier -factor is affected significantly by uncertainties on new concept's benefits both on a system- and individual device -level. In addition to uncertain benefits, the new concept being a new type of an offering and organizations having both positive and negative experiences on similar technology are elements, which influence new concept's risk barrier -factor as well. Organizations' perceptions on uncertainties relating to the new concept may be assessed overall as moderate, because incremental benefits of the new concept are considered uncertain and some concerns arise on the quality of analysis one is able to conduct with the new concept. Organizations' perceptions of complexity, trialability and observability of the new concept may be assessed as moderate as organizations on a general level understand the new concept, but due to its poor observability are unsure of concrete activities behind it. This results to new concept's overall risk barrier -factor of being moderate.

As risk barrier -factor is a customer-specific assessment it varies significantly organization by organization. Combined with study's limited sample implication of this is that with high probability a comprehensive view on overall risk barrier -factor was not presented. Nonetheless, presented findings represent wider concerns organizations have of the new concept and this is why they are applicable in industries outside this study as well.

4.6. TRADITION BARRIER -FACTOR OF CASE FIRM'S NEW OFFERING

Factor	Underlying elements
Tradition barrier	Psychological switching costs

Cultural and organizational changes a new offering implies to adopting organizations may become barriers for its trial and adoption. In the research framework tradition barrier -factor portrays significance of these barriers to trial and adoption of a new offering. As culture is interwoven to organization's activities, one would have to participate into customers' organization to understand these barriers in detail. With interviews one is able to only identify significant topics, which an organization states to affect its trial and adoption -decision. As negative statements are more common to be made than positive ones, through this approach reasons which prevent organizations from adopting a new offering will more probably be identified.

Organizations with own condition monitoring processes have developed their own capabilities on condition monitoring and on systems which assists in this activity. According to one interviewed organization being able to use condition monitoring hardware and software effectively requires a lengthy learning period, which is both an economical and psychological investment (Customer interview 7). As these capabilities do not want to be lost, these organizations consider conducting condition monitoring measurements with own resources a standard-solution. Switching from use of own resources to use of an external provider represents thus more than a process-change to these organizations. This is why a certain tradition barrier against adopting the new concept exists with high probability in these organizations (Customer interviews 7, 14, 16, 17, 18 and 22-24). Existing research on this topic indicates how re-allocation of tasks is a typical case where tradition barriers may play a role in an organization's decision-making (Sheth and Ram, 1987, Chapter 3).

Noteworthy of previous assessment is that chosen technological system and acquired lessons on it lock an organization into one way of operating. Path dependency of technological solution is thus reinforced over time by organization's learning and how resources in an organization are allocated. This is why tradition barriers may have their origins de facto on technological system, which has been implemented at an earlier point of time. This represents how different factors of the research framework are inseparably linked and may thus not analyzable one by one. Tradition barrier -factor specifically overlaps with areas of compatibility-factor based on the obtained findings.

As tradition barrier is defined in a loose manner and as scarce results on it were obtained, no clear additional underlying elements are identified to it in the case study. Based on obtained scarce evidence tradition barrier -factor may be assessed overall as moderate. As only organizations with own condition monitoring processes consider the new concept negatively, lower value is not justified. This finding may be considered generally applicable in different industries due to its general nature.

4.7. IMAGE BARRIER -FACTOR OF CASE FIRM'S NEW OFFERING

Factor	Underlying elements
Image barrier	Corporate image of the provider Perceptions of applied technology

A new offering has an image, which stems from its origins and either positively or negatively affects its trial and adoption. Image barrier -factor portrays these image-related effects in the research framework. As image is defined to stem from origins of a new offering, underlying elements of the image barrier -factor have been defined in the research framework to be corporate image of the provider and customers' perceptions of applied technology. These and possible additional elements will be analyzed in the following to understand image barrier -factor of the new concept comprehensively.

The new concept is a mixture of product and service components, whose costs with longer contract periods are determined by its service components. Whether Case firm is considered a convincing provider of this type of offering affects how new concept is perceived. Of the 25 interviewed organizations 21 recognize Case firm as a provider of products (Customer interviews). Only 10 of the interviewed organizations do though recognize Case firm as a provider of various services (Customer interviews 5, 7, 11-14, 18, 19, 21 and 24). According to Case firm's own experiences it is not recognized widely as a service provider (Case firm's senior sales manager). This is why new concept's image does not have perfectly credible background, which might be of significance to some organizations.

New concept brings together several technologies to deliver condition monitoring service in an unprecedented manner to organizations. Whether at its core it delivers something new is though a matter of assessment. 15 of the interviewed 25 organizations consider technology applied in the new concept to be older, which implies that in customers' views the new concept is not a technological innovation, but a re-configuration of existing technologies (Customer interviews 3, 6, 7, 10, 13, 15-20b and 22-24). This is why the new concept is understood as an offering more easily, but at the same time its differences to other similar offerings are considered more limited.

Interviewed organizations' understanding on condition monitoring technologies is limited. Beyond physical features majority of organizations are not able to differentiate one technology from another and they are not aware of how condition monitoring technologies have developed over years (Customer interviews). Organizations, which have a more thorough understanding on condition monitoring technologies, state similar offerings than the new concept to have existed for a long time and major changes in them have not taken place in the past years (Customer interviews 13, 15-18, 22 and 23). According to gathered qualitative data applied technology in the new concept is thus older but not widely understood.

No other clear topics relating to image barrier are identified in the case study. Case study though implies that image of the new concept depends on how organizations perceive it (Customer interviews). This is why organizations' perceptions on new concept's complexity, observability and trialability affect its image. In existing research framework these assessments are defined to affect risk barrier -factor, but they could define image barrier -factor as well.

Corporate image of the provider may be assessed overall as moderate, because Case firm is a recognized supplier of goods, but not that recognized as a service provider. Organizations' perceptions on the applied technology are moderate, as they consider it to be an older technology with limited newness' potential and are poorly aware of technology's details. To provide one overall statement on the image barrier -factor it has to be thus assessed to be moderate. As interviewed organizations perceive new concept's image in a similar manner, these findings are with high probability applicable beyond studied industries.

4.8. ASSESSMENTS' IMPLICATIONS TO LAUNCH DECISIONS -FACTOR OF CASE FIRM'S NEW OFFERING

As other elements of the research framework focus on attributes of a new offering and how it fits to adopting organizations, launch decisions -factor focuses on commercial design of a new offering and on how it is brought to market. An effective launch decisions -factor enables new offering's commercial success by defining its targeting, pricing and promotional activities and by augmenting the core offering with elements that promote its trial and adoption. Former manager of IBM's marketing, William Davidow, states aptly in his book why optimizing launch decisions -factor along other elements of a new offering is important:

> *Great devices are invented in the laboratory. Great products are invented in the marketing department... When a device is properly augmented so that it can easily be sold and used by its target group it becomes product (Davidow, 1986, Chapter 2).*

According to existing research commercial success of a new offering is promoted by mitigating its negative characteristics and by capitalizing on its positive characteristics (Guiltinan, 1999). Conducted assessments on the new concept indicate both negative and positive attributes, which respectively affect its optimal launch decisions -factor. Implications of conducted assessments to targeting, pricing and promotion of the new concept are

analyzed in the following. Analysis follows key assessments existing research suggests to be relevant for defining an effective launch plan for a new offering. Both obtained empirical findings and existing research insights are combined in these assessments to deliver concrete recommendations on an efficient commercialization of the new concept.

Central assessment for defining an effective launch plan is to identify customer segments where a new offering is able to contribute additional benefits (Kim and Mauborgne, 2005, Chapter 6; Mullins, 2006 and Jolly, 1997, Chapter 8). This influences targeting decisions and enables efficient marketing as potential customer groups of new offering have been pre-defined. Conducted assessments on the new concept indicate few common attributes for customers, which theoretically would gain additional benefits by implementing the new concept. In practice several of them have though implemented a comparable solution, which is why only a few of them represent potential initial adopters for the new concept.

A certain proportion of interviewed units have not implemented structural solutions to ensure their production processes' reliability, because they assume implementation costs to exceed achievable benefits. Implementation costs are assumed to be significant either because applicable critical equipment is expensive, thus raising costs of structural solutions, or because production processes are continuous with limited intermediate storages, thus requiring a more comprehensive and respectively more expensive structural solutions (Customer interviews 13, 20a, 20b and 23). While structural solutions are assumed to be infeasible in previous units, solutions like the new concept remain plausible options to ensure high reliability of individual devices. Because solutions like the new concept are able to deliver benefits that other solutions are not, units with expensive critical equipment and units operating continuous production processes with limited intermediate storages represent attractive target groups for the new concept. Notable of units with expensive critical equipment is that installed equipment may be expensive due to its size or due to its non-standard design. According to Case firm majority of large-size standard devices in Finland have a condition monitoring solution installed to them already (Workshop). This is why needs of a part of the target group may already be met. Notable of latter target group is that broad production processes consists of several sub-processes. This is why broad production processes should be analyzed on the sub-process level to understand whether continuous production processes with limited intermediate storages are present in a unit.

Optimally few tangible customer groups, which would benefit significantly from implementing the new concept and which would respectively form a natural initial customer group, could be identified for the new concept (Tidd and Bessant, 2009, Chapter 9 and Chiesa and Frattini, 2011). No concrete customer groups are though identified in the case study (Customer interviews). Similarly Case firm has not been able to specify clear customer groups, which would represent significant potential for the new concept. Majority of potential units have implemented either condition monitoring or structural solutions, which is why the new concept offers only limited added value to them (Workshop). As a result only individual units from various customer groups represent potential customers for the new concept. This limited number of potential initial customers indicates weak commercial potential of the new concept and is a significant issue considering its further trial and adoption.

Existing research has identified each new offering or an innovation to go through a pre-diffusion phase, where fitting applications are sought for it in a trial-and-error type of a process, before their wider adoption. Several new offerings and innovations remain in this phase as they fail to reach a sufficient amount of initial adopters, which typically are a requisite for wider adoption (Tidd and Bessant, 2009, Chapter 8). As limited number of organizations has adopted the new concept, it may still be considered to be in its pre-diffusion phase (Workshop). A firm may be able to shorten pre-diffusion phase and gather valuable feedback by forming closer customer relationships with early adopters in a market (Tidd and Bessant, 2009, Chapter 8 and Chiesa and Frattini, 2011). This is why it is

recommendable for Case firm to pursue closer co-operation with early adopters of continuous condition monitoring technologies to gain understanding on how they perceive the new concept and to understand potential further applications of the new concept.

A conclusion on the first key assessment is thus that the new concept is able contribute additional benefits in units with expensive critical equipment and in units which operate continuous production processes with limited intermediate storages. This is why it is recommendable to concentrate new concept's marketing and personal selling efforts to these types of units. Hitherto acquired information on these types of units implies that several of them have already implemented solutions, which deliver similar benefits than the new concept. This is why only a limited group potential initial customers presumably exists for the new concept. To be able to identify additional fitting applications for the new concept Case firm should pursue closer co-operation with early adopters of new concept's technology. Without additional initial customers new concept's wider adoption and respectively its commercial viability may be at risk.

An effective launch plan for a new offering stimulates a buying behavior pattern, which promotes its trial and adoption in the most efficient manner. This is why second key assessment for defining an effective launch plan is to assess whether one has to convince customers either to adopt a completely new solution, to switch their existing solution to an improved offering or to start using a new offering instead of other similar solution (Guiltinan, 1999). Relative newness of an offering and whether organizations have adopted similar offerings before are key aspects of this assessment.

According to interviewed organizations technology applied in the new concept is older, but it has been applied in organizations in a limited manner (Customer interviews). Out of 25 interviewed organizations 6 units have implemented either individual condition monitoring solutions or a condition monitoring system (Customer interviews 13, 16-18, 22 and 23). Remaining 19 units carry out manual condition monitoring measurements or do not rely on condition monitoring (Customer interviews 1-12, 14, 15, 19-21, 24). In addition, 15 of the 25 interviewed organizations state new concept's technology to be older (Customer interviews 3, 6, 7, 10, 13, 15-20b and 22-24). With a high probability a significant proportion of organizations have thus assessed benefits of condition monitoring to their operations over its long history.

As only limited benefits are reachable by substituting an existing condition monitoring solution with the new concept (Customer interviews) and as units not relying on condition monitoring have assumably assessed its benefits to be insufficient, an effective launch plan for the new concept should focus on stimulating buying behavior of units, which conduct solely manual condition monitoring measurements. Recommendable launch plan should thus aim to convince units to switch their existing solutions to an improved offering. Respectively marketing communication of the new concept should concentrate on highlighting its additional benefits versus manual condition monitoring measurements.

Notable of second key assessment for defining an effective launch plan is that according to existing research main buying behavior pattern results in a straightforward manner from customers' existing solutions (Guiltinan, 1999). Case study's sample is though an example that in a concrete market customers differ in terms of their existing solutions and in terms of their existing skills (Customer interviews). This is why defining a main buying behavior pattern, which launch plan aims to stimulate, is a more complex matter than only assessing customers' existing solutions. Applied logic in new concept's case is to prioritize a customer group, to which new concept is able to offer additional condition monitoring skills and knowledge, and to focus on their buying behavior pattern. Combined with described targeting this prioritization is assumed to promote trial and adoption of the new concept with highest probability. Other justifiable choices could also have been though made, for example

promoting buying behavior pattern of units which have not implemented a condition monitoring solution. As these units are though assumed to be lower in quantity in chosen target group and not to have interest in implementing condition monitoring solutions like the new concept, they have been de-prioritized. Theoretically straightforward assessment is thus based on case study multi-dimensional in practice. Instead of customers' existing solutions indicating one clear buying behavior pattern to promote, choice of which pattern to promote has to be made from several plausible options in an actual market.

Third aspect of an effective launch plan is to analyze key characteristics of a new offering and based on them determine pricing, promotion and distribution approaches in manner that they enable its commercial success. According to Guiltinan (1999) relative advantage and compatibility are offering's key characteristics, according to which essential commercial variables should be defined. Figure 24 summarizes assessments on research framework's factors influencing trial and adoption of the new concept. Efficient pricing, promotion and distribution approaches are thus assessed mainly based on new concept's overall low relative advantage and overall moderate compatibility.

1. Low relative advantage
Low relative benefits, which are uncertain to realize on a system-level
More expensive than manual condition monitoring measurements

2. Moderate compatibility
Low technological fit driven by new concept's low fit to existing system architectures
Overall moderate usage fit, which is higher with small- and medium-size organizations and lower with large-size organizations

3. Moderate risk barriers
Incremental benefits of the new concept are considered uncertain
Organizations on a general level understand the new concept, but are unsure of concrete activities behind it

4. Moderate tradition barriers
Losing the value of lessons a firm has accumulated poses a psychological switching cost for organizations with own condition monitoring resources

5. Moderate image barriers
New concept does not enjoy full benefits of Case firm's image as its service offering is not generally known
Organizations perceive new concept not to offer a new technology, but as a re-configuration of existing technologies

Figure 24. Overall assessments on factors influencing trial and adoption of the new concept

According to Guiltinan (1999) new offerings with low relative advantage and low compatibility will not be readily adopted by customers as they are able to deliver limited incremental benefits and are incompatible to customers' processes. In his view an effective launch plan for this type of new offerings is to lower adoption barriers to minimum with promotional measures and penetration pricing. For new offerings with low relative advantage and high compatibility same author recommends promoting Trial and Repeat -type of buying behavior by maximizing awareness over a new product, which drives its trials.

Based on conducted assessments new concept's relative advantage is overall low. In addition, benefits it contributes on a system-level are typically uncertain (Customer interviews). As organizations face uncertainties in adopting this type of a new offering, new concept's trial and adoption has presumably to be promoted for it to take place. According to existing research, applicable promotional measures are equipment allowances, leasing-options, money-back guarantees and warranties, which lower organizations' risks of adopting a new offering (Guiltinan, 1999). Besides leasing-options all of previous measures are viable to the new concept and this is why Case firm should consider them as potential elements of new concept's commercial offering.

According to Sheth and Ram (1987, Chapter 3) if an innovation provides low relative advantage in comparison to other available solutions, it has to be improved to increase its trial and adoption. One may achieve this by positioning innovation in an application where it has a stronger price-performance value or by reducing innovation's costs and reflecting obtained savings in its price. In the same manner Guiltinan (1999) states penetration pricing, that is low pricing in relation to costs, to be a recommendable approach for new offerings with low relative advantage and low compatibility as it is unlikely that a significant price-inelastic customer segment for them exists. Jolly (1998, Chapter 8) has found in his research that successful commercialization of new technological offerings is linked to aggressive pricing from beginning on. In addition, Kim and Mauborgne (2005, Chapter 6) state that offering's price-level should attract a significant quantity of buyers but at the same time discourage inevitable imitation. As case study and Case firm's own experiences indicate the new concept does not represent an attractive offering for a significant quantity of at the moment (Customer interviews, Workshop). A legitimate assumption thus is that new concept's price-level is not in-line with previous recommendations on successful pricing. This is why it should be critically assessed. Aim should be to significantly increase the amount of potential buyers either by implementing a penetration pricing approach or by reducing costs of the new concept and passing savings onwards to customers. Without more competitive pricing a critical mass of customers may not be reached.

Based on conducted assessments new concept's compatibility is overall moderate. Compatibility though depends on the size of the organization as new concept's fit to small- and medium-size units is better than to large-size units (Customer interviews). Low compatibility is thus more of an issue with large-size units. Recommended risk-based promotional measures and more aggressive pricing approach promote organizations to trial and adopt the new concept despite of its moderate compatibility (Guiltinan, 1999). Besides previously mentioned measures Sheth and Ram (1987, Chapter 3) propose that one may mitigate low compatibility by integrating an offering into an existing activity or product, by selling a wider system instead of sole offering or by making an offering mandatory through regulations. Feasibility of two of these recommendations, integration of the new concept into an existing product and selling the new concept along a wider system, are assessed based on theoretical and empirical insights in the following.

Integration of the new concept into an existing sub-system of COPS is challenging as in its current configuration it is designed to function as a stand-alone system and as architectures of COPS seldom change. Existing research indicates that new offerings typically become part of COPS architecture simultaneously with major technological or regulatory changes (Kash and Rycoft, 2000). As the new concept does not provide a step-change in performance and as its compatibility with existing architectures is poor (Customer interviews), benefits achieved by integrating it to COPS are with high probability undermined by required integration costs. This is why pursuing integration of the new concept to existing complex products or systems is not a justifiable approach.

Case firm's representatives consider integration of the new concept into existing COPS also an infeasible approach. In their view costs of necessary changes either in the existing architectures or in the new concept outweigh potential benefits (Workshop, Case firm's technical expert). Integration costs outweighing potential benefits has been identified in the existing research as a typical issue of offerings that link to COPS (Tidd and Bessant, 2009, Chapter 9). Regardless of this Case firm's representatives consider potential to exist in offering the new concept as an add-on to less complex large-size devices. As an add-on to large-size devices stand-alone design of the new concept is less of an issue, because its task in this type of a configuration limits to providing condition monitoring to an individual device (Workshop). While being logical reasoning, commercial potential of this approach may be limited as majority of large-size standard devices are assumed by Case firm to have a condition monitoring solution installed to them already (Workshop). Nonetheless, integration to less complex devices is worth pursuing in case interested parties may be identified.

One option to circumvent new concept's moderate compatibility is to offer it as a part of a wider system-level offering, whose internal compatibility is ensured. System-level offering may be a technical combination of several products or a combination of products and services, which together carry out certain a task in a system. According to Case firm's experiences outsourcing-trend in industrial services is increasing demand for these types of offerings (Case firm's senior sales manager), which is why it would be plausible to offer the new concept as part of one.

To be able to sell system-level offerings which link to surrounding systems a firm has to possess appropriate system integration capabilities (Bergek et al., 2008). Due to various suppliers and their differing standards Case firm assumes integration to existing systems to require capabilities on various system architectures and to be costly as integration to each supplier's system is a separate project to an extent (Case firm's technical expert). Key element differentiating existing systems is their embedded software (Customer interviews). If investments to understand different embedded software do not benefit Case firm's other offerings beyond the new concept, they are with high probability not justifiable. This is why decision on whether to pursue a system-level offering with links to surrounding system is dependent on Case firm's assessment on the value of building capabilities on different existing architectures and their embedded software.

According to Ghosh et al. (2006) supplier benefits from defining its offering more in detail, when technological development is unpredictable, when several incompatible standards are in use and when technical capabilities of customers are of low-level. In the new concept's case several incompatible standards are in use and technical capabilities of small- and medium-size organizations are typically low. At the same time though technological development is both slow in nature and predictable and technical capabilities of large-size organizations are high (Customer interviews). As applied technology and its development are familiar to its more potential adopters, that is large-size organizations, developing a pre-defined system-level offering may be less beneficial to a supplier in this case. Kaario et al. (2003) state that buyers with high levels of technical capabilities typically seek individual customizable offerings, while buyers with low levels of technical capabilities seek standardized system-level offerings. Their view concurs with that of Ghosh et al. (2006) that technically capable buyers offer less potential for wider pre-defined offerings. Case firm's experiences are in-line with these findings as its successful commercial offerings are based on its advantage on technical capabilities versus its customers and competitors (Case firm's senior sales manager). Offering the new concept as a part of system-level offering is thus an option, though as significant investments to system integration capabilities are required and as technically capable customers may not benefit from it, commercial viability of this is questionable.

Scope of an offering has implications to its appropriate distribution. Generally offerings with low relative advantage and low compatibility should be distributed intensively to promote their trial and adoption (Guiltinan, 1999). In addition, as extensive customization of COPS reduces search efforts of buyers, that is they rely on their existing suppliers, intensive distribution is one method to reach these difficult-to-reach buyers (Weiss and Heide, 1993 and Davies and Hobday, 2005, Chapter 2). Existing approach of carrying out personal selling to as wide group of customers as possible and aiming to combine the new concept as a potential add-on to possible sales offers is in-line with these recommendations (Workshop). If scope of an offering is developed more to a system-level, required one-time investment to it increases. Due to higher investment cost higher decision authorities would presumably have to be contacted in organizations (Case firm's senior sales manager). This change of focus of marketing efforts would temporarily result to inefficiencies, which should be considered as part of the decision on whether to pursue a system-level offering.

Based on previous discussion pricing, promotion and distribution approaches of the new concept should be altered to be in-line with its assessed relative advantage and compatibility. More specifically more aggressive pricing approach should be pursued and applicable risk-based promotional measures should be included as part of new concept's commercial offering. In addition, whether it is justifiable to offer the new concept as part of a wider system-level offering should be assessed. Critical assessment for Case firm is to determine a value on system integration capabilities it should acquire for to be able to do this. Both theoretical insights and Case firm's own views consider integration of the new concept into an existing sub-system of COPS to be an infeasible approach. Its integration to less complex offerings may offer limited opportunities and should be thus pursued further.

Final assessment existing research suggests to be relevant for defining an effective launch plan is to identify relevant customer barriers that may block adoption of a new offering and consider whether specific actions have to be taken to mitigate their effects. Based on conducted assessments (summary in Figure 24) new concept's customer barriers are in three defined areas of the research framework moderate. Whether recommendations on how to minimize negative barriers from existing research are applicable in this case will be discussed in the following.

Moderate risk barrier of the new concept are caused by its uncertain benefits on device- and system-level and organizations' mixed experiences on similar technologies. Sheth and Ram's (1987, Chapter 3) primary recommendation is to minimize negative effects of risk barriers with information-based promotion measures, for example with customer testimonials and with various demonstrations of an offering. If information-based promotion measures are ineffective, secondary recommendation of authors is to sell an offering as a part of a wider system-level offering, in which its risks are unobservable (Sheth and Ram, 1987, Chapter 3). Based on previous discussion on wider system-level offerings both recommendations are theoretically applicable for the new concept. Latter of them though requires further considerations on whether it is commercially feasible to sell the new concept as part of a wider system-level offering. This is why only Sheth and Ram's (1987, Chapter 3) primary recommendation is a readily recommendable approach for mitigating new concept's risk barriers.

Image barriers of a new offering may be lowered either by long-term promotion of a certain kind of image or by linking image of a new offering into an existing one (Sheth and Ram, 1987, Chapter 3). New concept's image barriers are created by Case firm not being recognized as a provider of industrial services and applied technology being considered an older one. Case firm has limited potential to alter customers' perceptions of applied technology, but it may affect how it as an organization is perceived. This is why Case firm should start a long-term promotion to increase its recognizability as a service provider. This would benefit not only the new concept, but other service offerings of Case firm as well.

According to Sheth and Ram (1987, Chapter 3) tradition barriers are difficult adoption barriers to deal with. Cost-effective solution in regard of them is to comply and adapt new offering accordingly. If this is not possible, one has to resort to education and promoting change agents within customers' organizations, which requires a long-term commitment. In new concept's case tradition barriers are relevant in cases where implementation of the new concept results to switching from use of own resources to use of an external provider (Customer interviews). As in its current configuration the new concept has been built on the assumption that organizations benefit from moving a traditionally internal task to an external provider, complying and adapting to existing way of operating is not an option. This is why Case firm has to rely on educating and promoting change by explaining benefits of outsourcing condition monitoring to potential adopting organizations.

Moderate customer barriers of the new concept are thus recommendable to be mitigated with various promotional approaches. Common to them is though that they require a long-term commitment from Case firm and they do not result to immediate results of increasing new concept's trial and adoption.

Conducted key assessments provide various recommendations on how new concept's commercial offering and targeting should be defined to promote its trial and adoption in an efficient manner. According to first key assessment units with expensive critical equipment and units operating continuous production processes with limited intermediate storages represent potential initial adopters of the new concept. Units with these attributes should thus be targeted with new concept's marketing and personal selling efforts. Limiting commercial potential of the new concept is that hitherto only individual units have been identified, where the concept has been able to offer significant added value. This implies a limited group of potential initial customers, which is a significant obstacle considering new concept's wider adoption. To understand further applicability of the new concept Case firm should pursue closer co-operation with early adopters of new concept's technology. Recommendation from second key assessment is that new concept's launch plan and marketing communication should focus on stimulating buying behavior of units which conduct solely manual condition monitoring measurements. In the chosen target group they are assumed to represent highest potential for the new concept. Third key assessment indicates that new concept should be offered with a more aggressive pricing approach and its commercial offering should include applicable risk-based promotional measures to mitigate its low relative advantage and moderate compatibility. In addition, whether the new concept should be offered as part of a wider system-level offering should be considered. Integrating the new concept to an existing sub-system of COPS is with high probability an infeasible approach as integration costs are assumed to exceed obtainable benefits. This is why it should not be pursued. Recommendations from the fourth key assessment are that Case firm should mitigate customer barriers influencing trial and adoption of the new concept by providing information-based promotional measures, by promoting its image as a provider of industrial services and by convincing customers of benefits of outsourced condition monitoring.

Previous recommendations are based on existing research findings on how trial and adoption of a new offering with certain attributes may be promoted further. By implementing these various recommendations on targeting, pricing and promotional measures new concept's launch decisions -factor is assumed to be in-line with its attributes and respectively enable its trial and adoption in an efficient manner. Noteworthy though is that without additional applications, where the new concept is able to offer substantial benefits, new concept's commercial potential will remain weak despite of any other implemented measures.

Launch decisions -factor differs from other factors of the research framework, because it portrays an approach, with which an offering is commercialized. Its efficient design depends on the attributes of the underlying offering, which is why definition of an optimal factor includes always a level of judgment. Even though of its different nature launch decisions -factor is a necessary part of the research framework to describe trial and adoption of a new offering or an innovation in a comprehensive manner. This study limits to recommending different aspects of a fitting launch decisions -factor without specific analysis on launch decisions -factor's influence on new concept's trial and adoption. This is why scarce evidence is available for further specification of launch decisions -factor. Two observations may though be made based on conducted assessments. First observation is that proposed assessment in the research framework concentrate on defining aspects of tactical launch decisions, while strategic launch decisions are not included in the analysis. Reason for this is that different strategic launch decisions define attributes of a new offering or an innovation, but affect its trial and adoption thereafter only in a limited manner. This is why strategic launch decisions should be defined in the research framework to be situated anterior to attributes of a new offering. This is portrayed in Figure 25 below. Second observation is that with an offering that links to COPS and to their sub-systems, decision on whether to integrate a new offering or innovation into an existing offering or offer it as part of a wider system-level offering bears high significance to its trial and adoption. This is why decision on integration approach should be defined as one strategic launch decision. In new concept's case decision to pursue a stand-alone system affects its trial and adoption widely (Customer interviews), which is why this decision should be emphasized in the research framework.

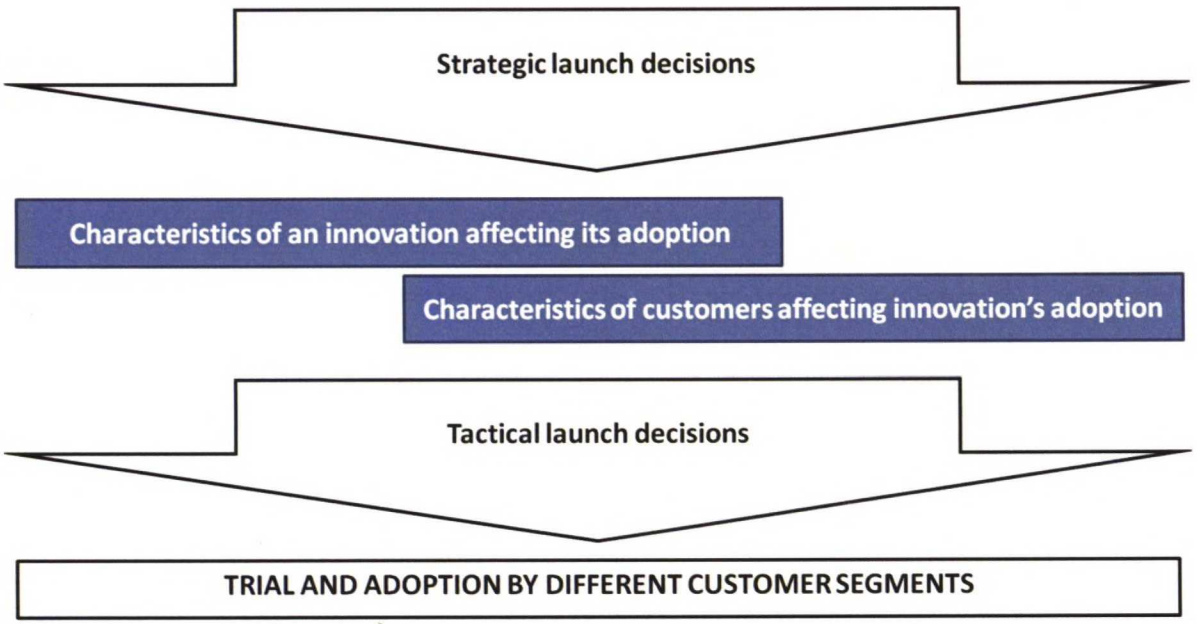


Figure 25. Influences of strategic and tactical launch decisions in the research framework

4.9. ASSESSMENTS' IMPLICATIONS TO THE RESEARCH FRAMEWORK

Research framework of this study has been combined from several literature sources to represent relevant factors influencing directly trial and adoption of a new offering. As its contribution it has provided a structure for a comprehensive analysis. As conducted assessments on different factors of it though indicate, its elements are not entirely mutually exclusive and collectively exhaustive; few underlying elements, which would ensure comprehensive analysis, are missing from it and launch decisions -factor is not presented in a logical manner in it. Implications of case study's assessments to the research framework and its structure are reviewed in the following. Discussion will proceed from additional underlying elements that should be included to the research framework to identified links and overlaps between different factors of the research framework. In addition, research framework's applicability in practice will be discussed based on a conducted workshop with Case firm.

Table 17 lists revised underlying elements of factors influencing new offering's trial and adoption. Items in *Italic* indicate underlying elements that have been either modified or added versus the original research framework. Carried out modifications are based on results of conducted assessments and their logic is discussed in the following paragraphs.

Table 17. Revised underlying elements of direct factors influencing trial and adoption of a new offering or an innovation

Factor	Underlying elements
Complexity	(Indirect effects through other factors)
Trialability	(Indirect effects through other factors)
Observability	(Indirect effects through other factors)
Relative advantage	Benefits of a new offering vs. Benefits of comparable solutions Costs of a new offering vs. Costs of comparable solutions
Compatibility	***... in term of ...*** - *existing system architecture* - *existing equipment* - *existing processes* - *existing skills and knowledge of customer's organization* - *existing values and norms*
Risk barrier	Uncertainties and potential unanticipated side effects Perceptions of an offering's complexity, trialability and observability *Organizations' experiences on similar offerings*
Tradition barrier	Psychological switching costs
Image barrier	Corporate image of the provider Perceptions of applied technology *Perceptions of an offering's complexity, trialability and observability*

In the original research framework compatibility-factor is defined to consist of two separate areas: technological - and usage fit. While this division seems to form logical units of

analysis, these fits are difficult to assess in a mutually exclusive and collectively exhaustive manner, because applied technology in an unit influences existing processes and vice versa (Customer interviews). In addition, while assessing adoption of a new offering each organization weighs underlying elements based on their preferences, which is why combining them to pre-defined areas may not reflect decision-making in reality. Because of these reasons, division of compatibility to two fits should be removed from the research framework. Implication of this is that compatibility-factor has to be assessed as one qualitative assessment, which incorporates both technological and usage aspects into one whole.

Underlying elements of various factors influencing trial and adoption have not been defined in the research framework to exact detail. Elements have been specified on a general level, for example compatibility to existing equipment and compatibility to existing system architecture, as their exact contents differ for each offering. Considering technological aspects of compatibility one significant finding on exact contents is though made, which is worth specifying. Technical switching costs indicate costs of switching from the use of existing solution to the use of a new offering. Finding in case study is that technical switching costs of offerings that are sub-systems to complex products or systems may arise both of direct costs of changing an existing solution to a new offering and of costs of integrating a new offering to an existing system architecture. As latter costs are at times more significant than previous, they are an important aspect to consider when assessing an offering's compatibility. Other significant finding on exact contents is on usage aspects of compatibility. Case study shows that it is important to consider whether resource-requirements of an offering fit available resources of an organization. Resource-thresholds, after which implementing a certain solution is justifiable, might be relevant topic to consider for an offering. In addition, if an offering requires an organization to devote more or less resources to an activity, it with high probability has implications to its adoption decisions. These resource-related assessments do not justify specifying an additional underlying element to the research framework, but they should be assessed as part of offering's fit to customer's existing processes.

In addition of specifying contents of few underlying elements case study indicates one additional underlying element to the research framework. Organizations' experiences on similar offerings or on similar technologies predefine their perceptions of a new offering and thus impact uncertainties organizations perceive to relate to it. This is why an assessment on these experiences should be included to the risk barrier -factor of the research framework. This additional underlying element specifies ambiguous risk barrier -factor further.

Characteristics of an innovation, that is its complexity, trialability and observability have been defined in the original research framework to influence predominantly risk barrier -factor. After case study's assessments it is evident that image of an offering depends on how organizations perceive it. This is why organizations' perceptions on new offering's complexity, observability and trialability affect its image barrier -factor as well. These three characteristics of an offering thus have an effect both on risk barrier and image barrier -factors.

In Figure 26 revised version of the research framework is shown. Numbered arrows indicate links and potential overlaps between different factors. Carried out modifications to original research framework are based on results and obtained insights from conducted assessments. Both modifications and observed relations between different factors of the research framework are reviewed in the following.

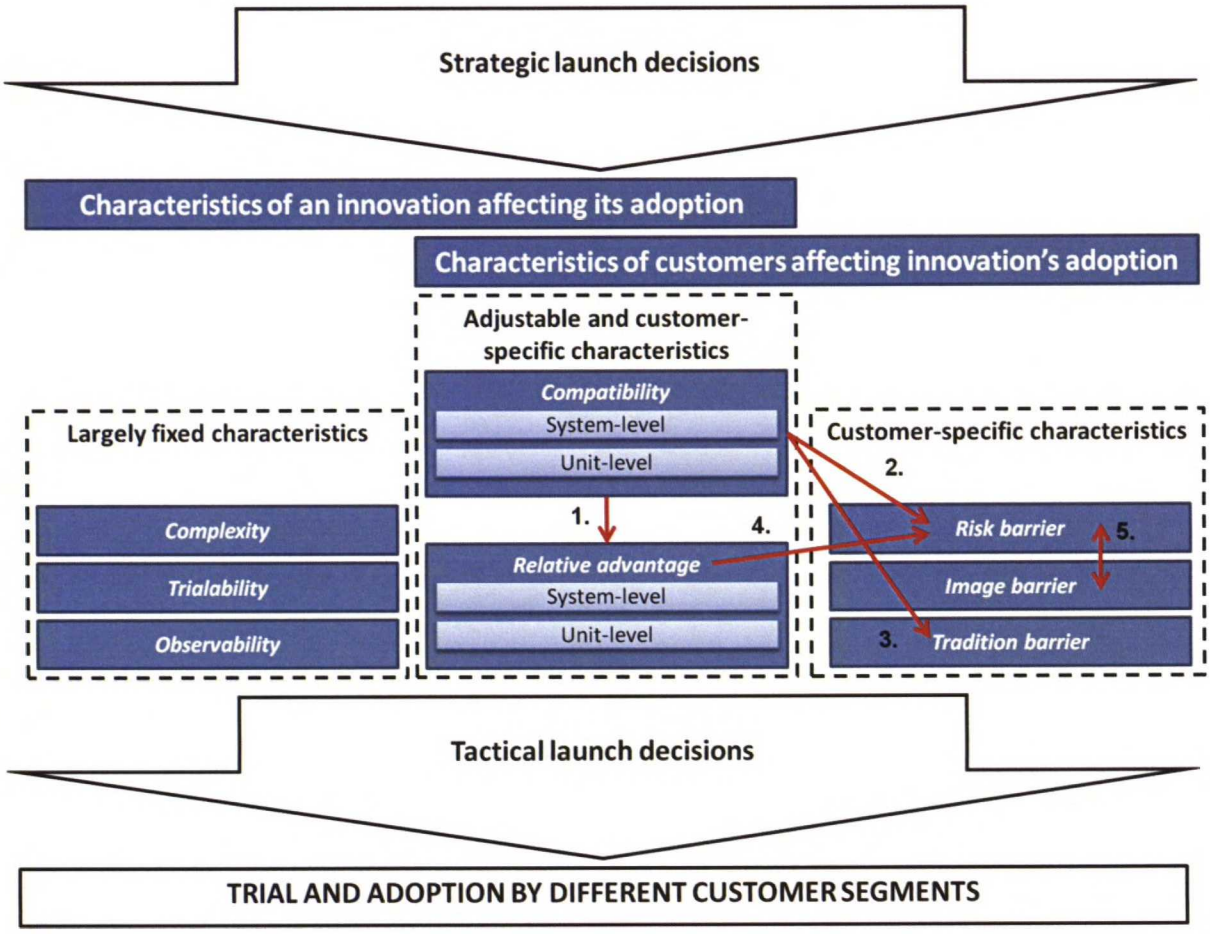


Figure 26. Revised framework portraying factors influencing trial and adoption of an innovation. Arrows indicate dependencies between different factors of the research framework.

Offering in the case study may be considered a sub-system to COPS. In assessments of relative advantage, compatibility and risk barrier -factors it is identified that separate assessments have to be conducted on an individual device -level and on a system-level to understand attributes of this type of an offering in a comprehensive manner. Presumably system-level benefits and compatibility differing from that of individual device -level is a more significant trait with offerings that links to COPS. Nonetheless, structure of the original research framework, which is designed to be applicable to new offerings in general, does not reflect necessity of assessments in various levels. This is why unit-level and system-level assessments are explicitly specified for relative advantage and compatibility -factors in the revised research framework. As risk barrier -factor is a widely defined unit of analysis, it includes both unit-level and system-level perspective readily. This is why necessity of unit-level and system-level assessment is not emphasized to it in the revised research framework.

Second structural change to research framework is to place strategic launch decisions anterior to attributes of a new offering. As observed in the case study, strategic launch decisions influence attributes of a new offering and its tactical launch decisions, but affect its trial and adoption thereafter only in a limited manner. This is why altered location for these decisions in the research framework is more logical than original one. In addition to re-defining launch decisions -factor into two separate sections, case study implies that with offerings that link to COPS an important launch decision is to define whether to integrate a new offering or an innovation into an existing offering, whether to offer it as part of a wider system-level offering or to offer it as its individual offering. This is why decision on integration approach of an offering should be included as an additional strategic launch decision.

Results of the case study imply several factors of the research framework to be linked and depending on one's definition even to overlap in certain areas. This is problematic as an optimal research framework would be mutually exclusive and collectively exhaustive. Observed relations between different factors of the research framework, which are indicated with numbered arrows in Figure 26, are discussed in the following.

An evident link in the research framework is between relative advantage and compatibility -factors (Arrow number 1). Relative advantage factor has been defined to consist of relative benefits and relative costs of an offering. With offerings that link to COPS relative benefits and even more significantly relative costs depend on an offering's compatibility to existing equipment and system architecture. This is why it is presumable that with offerings that link to COPS compatibility affects relative advantage to an extent. As various studies have stated these two factors to have a significant effect on trial and adoption of a new offering (Guiltinan, 1999, Rogers, 2003 and Chiesa and Frattini, 2011) and this dependency has not been commented upon, one may assume that the dependency is less significant with other types of offerings. Nonetheless, potential for this dependency between relative advantage and compatibility -factors should be indicated in the revised research framework.

Besides potentially influencing relative advantage of an offering, compatibility-factor may affect risk (Arrow number 2) and tradition barriers (Arrow number 3) of an offering. As risk barriers arise of uncertainties that customers perceive to relate to an offering, lacking compatibility either in terms of technology or usage may cause customers to perceive additional risks to relate to an offering and respectively increase risk barriers (Customer interviews). Presumably superior compatibility affects risk barriers vice versa, but in the case study only negative effects could be identified. As case study implies organizations to lock into one way of operating based on their existing technologies and processes, compatibility links to tradition barriers in similar manner than with risk barriers (Customer interviews). Lacking compatibility thus implies more significant changes to the status quo of an organization, which implies that stronger tradition barriers have to be overcome. These links are not undisputable, but as case study implies them their potential existence should be indicated in the revised research framework.

In case study's assessments it is observed that system-level benefits of an offering may be uncertain even though of improved performance on an individual device -level. This is because improvements in certain area of a system may be negated by system's existing limitations or bottlenecks (Customer interviews). This trait is a relevant theme to systemic new offerings and innovations. In case system-level benefits of an offering are uncertain to an extent, they reflect in the research framework as imprecise relevant advantage -factor and as further risks in risk barrier -factor. This is why relative advantage and risk barrier factors may be argued to be linked (Arrow number 4). One potential solution to remove this dependency would be to separate assessments on uncertainties relating to relative benefits from other uncertainties. Either assessment have to be carried out in this manner or it has to be considered that these two factors of the research framework are at least with offerings that link to COPS dependant.

Dependency between risk barrier and image barrier factors indicated in the revised research framework (Arrow number 5) is not obvious in the original research framework. Through adding proposed additional underlying elements to risk barrier and image barrier factors these links though become evident. As customers' perceptions on an offering's complexity, trialability and observability affect both of these factors a certain correlation may be assumed to exist between them. In addition, case study shows that uncertainties and potential unanticipated side effects that customers perceive to relate to an offering may stem from their perceptions of the applied technology (Customer interviews). This represents a second link between these factors. By combining risk and image barriers one would be able to

remove this interdependency from the research framework and thus form a more mutually exclusive and collectively exhaustive research framework. For the reason of clarity though these two factors are separated from each other in the revised research framework. Potential dependency between these two factors has to be though considered to exist, when applying the framework in research or analysis.

One aim of case study has been to apply formed research framework in practice and to test its applicability. As conducted assessments and recommendations devised based on them indicate, research framework is an applicable solution to understand trial and adoption of an offering in a comprehensive manner. To test this type of constructs outside one's own research Kasanen et al. (1993) have defined market-based validation to be an applicable solution. In the conducted workshop with the Case firm, revised research framework was overviewed and its implications to Case firm's new concept were discussed. As managers were willing to apply case study's research framework to an actual problem and follow its structure, revised research framework passed its weak market test (Workshop). Case study's research framework thus has been considered valid in a weak manner. Stronger confirmation of its practical applicability would be semi-strong market test, which would mean that it is widely adopted by companies. This though could not be conducted in the scope of this research.

Original research framework, which was combined from several literature areas to represent complex phenomenon of trial and adoption by different customer segments, was successfully applied in this case study. Its structure enabled a comprehensive analysis of this multi-dimensional phenomenon and it passed weak-market test as managers were willing to apply it to an actual problem. Conducted assessments following its structure though implied several areas, where original research framework could be specified further to improve its exactness and to show in a clear manner links and potential overlaps between its different factors. Corrections arising of these observations have been reflected in the revised research framework (in Figure 26) and on the list of revised underlying elements of research framework's factors (in Table 17). This theoretical output will serve as a basis to build on in further attempts to improve our understanding on factors influencing trial and adoption of new offerings. A significant point deserving further research attention is to gather more evidence on links and potential overlaps between different factors of the research framework. With this information framework could be made more mutually exclusive and collectively exhaustive, which would improve its applicability in future researches.

5. DISCUSSION: TRIAL AND ADOPTION OF A NEW OFFERING IN THEORY AND IN PRACTICE

5.1. 1st RESEARCH QUESTION: TRIAL AND ADOPTION OF A NEW OFFERING FROM A THEORETICAL PERSPECTIVE

1. Which factors and underlying elements influence trial and adoption of a new offering?

The first research question aims at identifying factors influencing the trial and adoption of new offerings in a comprehensive manner. To provide an answer to it a framework, which summarizes existing research on factors influencing trial and adoption, was formed and it was applied to a concrete case to confirm the legitimacy of its contents. Based on obtained insights from the case study, the original framework was revised to reflect in a more comprehensive and logical manner factors influencing the trial and adoption of new offerings.

In Figure 26 on Page 96 the revised research framework portraying different factors influencing the trial and adoption of new offerings is shown. This framework, which incorporates existing research knowledge and this research's findings, provides a comprehensive answer to the first research question and is the key theoretical contribution of this research. Elements underlying its different factors are specified in Table 17 on Page 95. Framework's individual elements are not specified in further detail, as they follow to a large extent existing research typology, which has been thoroughly reviewed in the synthesis of the literature review. Theoretical contributions of this research, according to which the research framework has been revised, are though reviewed in the following, because they potentially add to the existing research findings. List of this research's theoretical contributions is shown in Table 18. As indicated, besides forming a comprehensive framework on the topic, conducted research contributes to the existing research by specifying the structure of the research framework further and by defining additional elements to it.

In the case study's assessments three structural topics of the research framework arise as areas requiring adjustments or further analysis. Changes two of these topics imply to the research framework have been implemented, while implications of the third topic have not been reflected because further empirical evidence is required to define appropriate changes. One implemented change to the research framework's structure is that with relative advantage and compatibility factors unit-level and system-level attributes are portrayed as separate elements in the research framework. The observation that these factors have to be assessed both on a unit-level and on a system-level to understand them in a comprehensive manner is the rationale behind this modification. As framework does not readily reflect necessity of assessments in various levels, this is a justifiable change to the research framework. Changing the structure of the research framework in this manner is consistent with existing research, as systemic offerings have been identified to face the challenge that improvements they provide on a unit-level may be negated by system's limitations or bottlenecks (Tidd and Bessant, 2009, Chapter 9). This is why case study's observation and according modification to the research framework is not an additional insight to the existing research, but only a noteworthy clarification to the revised research framework.

Second implemented change to research framework's structure is that the strategic launch decisions are positioned anterior to attributes of an offering. This change in research framework's logic is implemented, as the strategic launch decisions are observed to have an effect on attributes of a new offering and on its tactical launch decisions, but to influence the

trial and adoption of offerings only in a limited manner. With this modification original logic of having tactical and strategic launch decisions as one interwoven factor is reversed. As the research framework has a more logical order of decisions with this change, this is though acceptable. This observation and according modification does not represent an additional insight to the existing research, but as a clarification to the revised research framework it is a theoretical contribution of this research.

Table 18. Theoretical contributions of the research

	Theoretical contributions of the research
1.	*Creating a research framework, which portrays factors influencing trial and adoption of a new offering in a comprehensive manner (Figure 26 in page 96 and Table 17 in page 95)*
2.	*Identifying links and potential overlaps between different factors of the research framework*
3.	*Specifying separate unit-level and system-level assessments to be relevant to understand relative advantage and compatibility of an offering in a comprehensive manner*
4.	*Observing strategic launch decisions mainly to define attributes of a new offering. This is why strategic launch decisions should be defined in the research framework to be situated anterior to attributes of a new offering.*
5.	*Re-defining compatibility-factor to form a logical unit of analysis*
6.	*Identifying organizations' experiences on similar offerings or on similar technologies to be a relevant additional underlying element of the risk barrier -factor*
7.	*Identifying organizations' perceptions on new offering's complexity, observability and trialability to affect its image barrier -factor in addition to risk barrier -factor*

In the case study's assessments factors of the research framework are observed to be linked and depending on one's definition even to overlap in certain areas. This is a problematic quality as an optimal research framework would be mutually exclusive and collectively exhaustive to enable an uncorrelated analysis of different factors. Numbered arrows indicate links and potential overlaps between different factors in Figure 26 on page 96. The logic behind each numbered arrow is explained on pages 97-98. These dependencies and potential overlaps between different factors of the framework are indicated in the revised research framework, but no concrete changes to framework's factors are carried out because of them. This approach is justifiable as these dependencies and potential overlaps are based on evidence solely from a single case study, which is insufficient to justify significant modifications to the definitions of different factors influencing the trial and adoption. Considering that similar researches on the factors influencing the trial and adoption of new offerings have been carried out and no discussions on dependencies between different studied factors have been carried out (Guiltinan, 1999, Rogers, 2003 and

Chiesa and Frattini, 2011), a multi-case study is called for to clarify the insights obtained in this research. If confirmed by other studies, Case study's observations on dependencies between factors influencing the trial and adoption of new offerings are additional insights to the existing research.

Why studies analyzing relative advantage and compatibility factors of different offerings have not identified dependencies between these two may be because factors were not analyzed as a combination, but each factor was assessed individually. It may also depend on studied offerings, which in this research's case was a systemic offering, which has various links to its surrounding systems. Because no definite answer may be given, dependencies between factors influencing trial and adoption of new offerings have to be studied further to understand their implications to new offerings' trial and adoption.

In case study's assessments three noteworthy observations on underlying elements of research framework's factors were made. The existing definition of compatibility-factor has been considered throughout the research to be inapplicable, as it combines several elements together, which do not form a logical unit of analysis. In the original research framework, which was defined solely based on the existing research, compatibility was divided into two sub-categories, technological fit and usage fit, to form more logical units of analysis. Case study's assessments though indicate that this artificial division into sub-categories is not plausible as technological and usage aspects of an offering are interlinked in many respects. This is why it is concluded in the revised research framework to define compatibility factor as one comprehensive element without sub-categorization. Besides defining underlying structure of the compatibility-factor theoretical contribution of this research is to include offering's fit to existing system architecture as one of its underlying elements. This is a relevant aspect to consider with offerings that link to their surrounding systems as conducted case study shows. Neither of these insights represents significant additional insights to the existing research, but they clarify formed research framework and thus may be considered contributions to the existing research.

Conducted case study implies that organization's experiences on similar offerings affect risk barriers they perceive to relate to an offering. This is why organization's experiences on similar offerings is included as an additional underlying element to the risk barrier -factor in the revised research framework. Whether this is an additional insight to the existing research depends on one's assessment, as risk barrier -factor has been defined in an ambiguous manner, thus including various perspectives to it. In a strict sense though no underlying element of original risk barrier -factor concentrates on antecedents of existing perceptions and this is why this modification to the research framework represents at least a minor additional insight to the existing research.

One underlying element, organizations' perceptions on new offering's complexity, observability and trialability is observed in the case study to affect both risk barrier and image barrier factors. With these two imprecisely defined factors it is difficult to define causality in a precise manner. This is why in the revised research framework this underlying element influencing two factors is considered acceptable. By combining risk and image barriers one would be able to remove this interdependency and accordingly form a more mutually exclusive and collectively exhaustive research framework. For the reason of clarity though these two factors are kept separated in the revised research framework.

Considering the process of how the key theoretical contribution of this research, the revised research framework, has been formed, few deficiencies of it become apparent. Existing research states findings on the relative significances of factors influencing trial and adoption of new offerings. Key finding on them is that relative advantage and compatibility of an offering have the greatest influence on its trial and adoption (Guiltinan, 1999). As this research has concentrated to compiling different factors influencing trial and adoption into a

single research framework, it does not provide further insights on the relative significances of different factors. This is why the revised research framework may only be merited of indicating factors influencing trial and adoption of new offerings, but not of clarifying their relative significances. This is an area of the research framework requiring further research to confirm existing research findings and to specify relative significances of other factors.

Besides missing information on relative significances, a significant deficiency of the revised research framework is that its practical applicability and contents have been tested only in a limited manner. Even though it has passed a weak market test, which requires managers to be willing to apply the framework to an actual problem, no concrete evidence on all of its causalities may be provided. For example neither this nor the existing research proves in an undisputable manner that an improved compatibility -factor leads to an increased trial and adoption of a new offering. As limited resources did not enable observing offering's trial and adoption over time, evidence required to indicate this type of changes could not be obtained. Causalities of the research framework are another area, where further research is required to confirm the research framework's factors.

As previous discussion indicates answer to the first research question could to a large extent be derived from existing research findings. Noteworthy of these findings though is that they had been only partially compiled into a comprehensive research framework, which would portray complex topic of trial and adoption of new offerings. This is why this research's major theoretical contribution is to bring existing knowledge into one framework, while minor contributions are more specific definitions of different factors influencing trial and adoption of new offerings. As carried out research represents initial attempts to analyze trial and adoption of new offerings in a comprehensive manner, research framework formed in it is not fully mutually exclusive and collectively exhaustive and relative significances of its factor are unclear to an extent. Further research is thus required to perfect the revised research framework to be applicable to a wide range of offerings.

5.2. 2nd RESEARCH QUESTION: RECOMMENDATIONS TO CASE FIRM

Assessments on new concept's relative attributes and its efficient launch decisions -factor have been conducted to answer in a comprehensive manner the second research question of the study:

2. How is Case firm able to promote commercial success of its new offering?

As summary on the key factors influencing trial and adoption of its new offering in Figure 24 in Page 88 shows, Case firm's new concept has in general low relative advantage and its attributes in other factors of the research framework are assessed as moderate. Relative advantage and compatibility being factors with the most significant effect on the trial and adoption of a new offering, it is presumable that the adoption of the new concept is slow, if it takes place at all. Case firm's experiences thus far support this assumption to be correct. Low values on these factors result to limited quantity of potential initial adopters and place the commercial viability of the whole concept at risk. Primary recommendations of this research propose solutions to this key issue regarding the new concept. As focus should be in correcting key aspects of an offering before adjusting its augmentation or its marketing efforts, other measures on how to promote its trial and adoption are stated as secondary recommendations of the research.

Primary recommendations of the research are shown in Table 20 below.

Table 19. Primary recommendations of the research to Case firm

	Primary recommendations of the research
1.	*Implement penetration pricing approach for the new concept or reduce costs of the new concept and pass on the savings to customers to increase the amount of potential buyers for the new concept*
2.	*Target personal selling and marketing efforts a) to units with expensive critical equipment and b) to units operating continuous production processes with limited intermediate storages as they represent most potential initial adopters for the new concept*
3.	*Pursue closer co-operation with early adopters of new concept's technology to understand its further applicability. Aim of this co-operation should be to identify additional potential initial customers for the new concept.*

As carried out cost comparisons indicate, the new concept is a more expensive solution than prevailing condition monitoring approaches. Considering that the new concept delivers more exact condition monitoring than prevailing condition monitoring approaches, comparison between these two is not entirely valid. Assessments on new concept's benefits though indicate that achievable additional benefits with it are limited. This is why Case firm has to lower costs to improve new concept's price-to-performance ratio and accordingly its relative advantage. As first recommendation states, costs may be lowered either by implementing a penetration pricing approach or by passing on achieved cost savings to customers. With penetration pricing approach one has to assess achievable profitability with different number of customers and adjust new concept's pricing to a competitive level based on an assumption on achievable sales. Lowering new concept's margin may sound counterproductive to achieving commercial success, but case study and Case firm's experiences imply that a more optimal pricing level in terms of aggregate sales and aggregate profits is achievable.

Optimally targeting of new concept's personal selling and marketing efforts could be specified to few tangible customer groups. No concrete customer groups were though identified over the course of the study. This is why targeting has to be defined in terms of units' attributes in the second primary recommendation. Case firm should target stated units as they offer generally potential for condition monitoring solutions and as solutions like the new concept have higher relative advantage in them. Initial information on these types of units implies that several of them have an implemented solution, which delivers similar benefits than the new concept. This is why only a limited group potential initial customers presumably exists for the new concept. To be able to identify additional initial customer for the new concept, Case firm should pursue closer co-operation with early adopters of new concept's technology to understand its further applicability.

Limited quantity of potential initial adopters is the key issue of the new concept that primary recommendations of this research aim to solve. The first primary recommendation is to pursue more aggressive pricing, which is assumed to increase the amount of potential adopters by making the new concept more competitive against other similar solutions. The second primary recommendation clarifies new concept's targeting and thus ensures that most potential initial adopters are reached with personal selling and marketing efforts. The third primary recommendation aims at increasing amount of potential adopters through identifying additional applications for the new concept. To enable new concept's wider

adoption Case firm should implement these recommendations. If these recommendations cannot be implemented or they are ineffective in increasing the quantity of potential initial adopters, commercial viability of the new concept is at risk.

Secondary recommendations of the research are shown in Table 21 below. They are not assumed to increase quantity of potential initial adopters for the new concept like primary recommendations are. Nonetheless, they are assumed to promote new concept's trial and adoption further by mitigating potential adoption barriers relating to it.

Table 20. Secondary recommendations of the research to Case firm

	Secondary recommendations of the research
1.	*Implement applicable risk-based promotional measures – examples of which are equipment allowances, leasing-options, money-back guarantees and warranties – to lower organizations' risks of adopting the new concept*
2.	*Mitigate customer barriers influencing trial and adoption of the new concept by providing information-based promotional measures, which for example are customer testimonials and various demonstrations of an offering; by promoting Case firm's own image as a provider of industrial services and by convincing customers of benefits of outsourced condition monitoring.*
3.	*Assess whether the new concept could be offered as a part of a wider system-level offering to circumvent issues relating to its compatibility. As integration costs are assumed to exceed obtainable benefits, integration to an existing sub-system of complex product or system is an infeasible approach.*

Owing to the nature of condition monitoring and to new concept being a systemic offering, that is it is linked to a surrounding system, its benefits are uncertain in majority of applications. In addition, other adoption barriers may exist because Case firm is not that recognized as a service provider and because implementation of the new concept means to some organizations outsourcing traditionally internally conducted task. To mitigate these potential adoption barriers, Case firm should implement various recommended promotional measures. Considering Case firm's existing approach these recommendations factually are not extensive modifications to its personal selling and marketing efforts. Implementation of risk-based promotional measures is though an exception as it would be a significant modification to the existing commercial offering. This is why of the possible risk-based promotional measures, that is equipment allowances, leasing-options, money-back guarantees and warranties, ones should be assessed which fit the new concept's offering and promote its trial and adoption in an effective manner.

Even though the new concept is designed as a parallel system in several cases it links to a complex product or system, whose functionality it aims to increase. This is why it has to be perceived as a systemic new offering, with which effects to surrounding system have to considered. As recommended, its integration into an existing sub-system of complex product or system is with high probability an infeasible approach. Its integration to less complex offerings may though offer limited opportunities and should be thus pursued further. Whether it is justifiable to offer the new concept as part of a wider system-level offering depends on if an offering solving a significant customer need may be formed around the new concept and on Case firm's assessments on the value on system integration capabilities it should acquire to be able to sell a wider system-level offering. Based on these assessments Case firm will

be able to decide whether to pursue some type of a system-level offering or whether to develop the new concept further as a sole stand-alone system.

While primary recommendations aim at solving a single clear issue, secondary recommendations of this research are aimed at mitigating various identified adoption barriers. Most significant of these adoption barriers is moderate compatibility of the new concept, but as it can be influenced only in a limited manner, secondary recommendations concentrate on mitigating adoption barriers arising of customers' perceptions. While important aspect of a commercial offering, these recommendations have a second priority in comparison with primary recommendations of this research.

Reviewed primary and secondary recommendations thus answer the second research question of the research. According to them Case firm should primarily address low relative advantage of the new concept and attempt to identify further applications for the new concept. Thereafter implementation of specific marketing measures and changes in new concept's commercial offering should be considered to minimize potential barriers hindering its trial and adoption.

5.3. LIMITATIONS OF THE RESEARCH

Various limitations of the research have to be taken into account, when assessing its findings and their wider applicability. Limitations to wider applicability of its results are relevant as the conducted research is a single case study, it focuses to a specific area on a wide and complex topic, its sample consists of only a limited number units and its research methodology has certain limitations. Many of these limitations match the expectations at the beginning of the research, as they result from the chosen research design. In the following paragraphs various limitations of the research are reviewed and scope of applicability of its results is discussed.

Research design pre-defines certain limitations to a research. As this research was a single case study concentrating on one offering in few industries, its results are not generally widely applicable. From an academic research perspective, its theoretical contributions have to be confirmed by other researches studying the trial and adoption of new offerings. Nonetheless, as this research's theoretical contributions build on the existing research, probability that they are applicable more widely than to this case is higher. From a practical perspective, research's concrete recommendations are applicable with certainty only in studied industries. As similar devices and systems are though in use in other industries as well, recommendations on how to promote trial and adoption of the new concept are assumed to be effective regardless of the industry. Noteworthy though is that carried out cost comparisons are applicable only in Finland, which is why research's recommendations assumedly limit to this country.

Due to limited resources, offering's trial and adoption could not be observed over time. Because of this type of data is missing, assumed causalities of the research framework could not be confirmed. For example, research assumes low relative advantage and moderate compatibility of the new concept to lead to its slow trial and adoption by different customer segments. Initial evidence of this is observed in the research, but with certainty this cannot be stated to be the case. Similarly missing data on factual trial and adoption of the new concept prevents analysis on relative significances of different factors influencing trial and adoption. These are noteworthy limitations of the conducted research, which future researches should address by studying the trial and adoption of new offerings over time applying the revised research framework's structure.

The reliability of this research has been sought to be improved according to the principles of triangulation approach by collecting data from various sources. Primary data source of this research was the qualitative data collected in interviews of Case firm's customers and secondary data sources were both Case firm's internal materials on costs and qualitative data collected in interviews within Case firm. Considering quantity of data, primary data source represents majority of available data. This is why limitations of the primary data determine whole research's limitations in a significant manner.

As empirical part of the research was constrained by limited resources, it focused on two industries. These two industries were chosen because they represented two potential customer groups for the Case firm's new concept and combined they contained an amount of firms, which would represent an appropriate sample in the context of this research. Sample of the research is thus a convenience sample to an extent. This is why it does not provide an optimal basis to analyze factors influencing trial and adoption of the new concept, but one that is biased with certain inputs. Improving sample's applicability is though that units from few other industries could be included to it and thus provide additional perspectives. Nonetheless, a limitation of the conducted research is that it is based on primary data that is collected mainly from two industries, which is why it is certain that some perspectives on the new concept were not observed in the case study.

A limitation arising of the research process is that acceptance rates for interviews varied with different interview groups. Interviewees having knowledge of similar offerings than the new concept or having experience with activity relating to the new concept accepted interview requests with a higher probability than other interviewees. Interviewees who had already implemented a similar solution had though a higher probability of refusing from an interview. In addition, Case firm's existing customers accepted interview requests more often than firms that did not have a clear customer relationship with the Case firm. Because of these differences in acceptance rates, studied sample was biased to include disproportionally more units, which had some experience of condition monitoring activities, which had not yet implemented a condition monitoring solution and which were Case firm's existing customers. This limited inputs to research from organizations, which had limited knowledge of condition monitoring activities and which had recently implemented a condition monitoring solution. As latter of these groups could have provided valuable insights to the topic, this is another limitation to the conducted research.

Further limitation arising of the research process was that setting for interviews was not optimal for a scientific research. Even though of separate remarks, researcher was portrayed as a representative of Case firm, which is why it was difficult to create an optimal atmosphere for an interview. This might have limited the information that was obtained in the case interviews. Developing the questionnaire over the interviews did not represent an additional limitation to the research, as questionnaire's contents did not change significantly but only its order of questions and structure. One additional perspective limiting research's results is that as maintenance organizations were interviewed, perspectives on the new concept remained in many cases on a certain organizational level. In interviews, where several representatives of organization were present this though was not the case.

As a conclusion on research's limitations it may be stated that its research approach, limited resources and it being conducted as a representative of Case firm, most significantly limit its results and their wider applicability. In general, its concrete recommendations on how to promote trial and adoption of a new offering are assumed to be applicable in various industries for it, but research's additional theoretical contributions have to be re-confirmed with further research.

5.4. MANAGERIAL AND THEORETICAL IMPLICATIONS OF THE RESEARCH

This research's results provide basis for various managerial and theoretical implications. Even though the conducted research stressed practical application instead of theoretical contributions, it provides a balanced set of implications for both of these areas.

Key managerial implication of the research is that it provides a comprehensive framework, according to which a manager may assess trial and adoption of a new offering. This information has been available as several separate factors, but this research provides it in one comprehensive form. In this combined form it assists managers in considering all factors that are relevant for a new offering's adoption and respectively its commercial success. Especially including both characteristics of a new offering and characteristics of adopting organizations is an additional insight, which managers should apply in practice. Analyzing new offerings' attributes through the formed research framework also enables managers to take corresponding actions to promote their offering's commercial success further. Without understanding on different factors, this would not be possible in a comprehensive manner.

In addition to clarifying factors that influence trial and adoption of new offerings to managers, conducted research offers managers dealing with systemic offerings insights on what to consider in their trial and adoption. Interdependency of relative advantage and compatibility - factors is a key consideration that managers should note. In addition, relevance of unit- and system-level assessments to understand these two factors in a comprehensive manner is an important aspect to remember. Without this managers may forget to assess their offerings' system-level attributes, which might differ from those of in unit-level.

Key theoretical implication of the research is that factors influencing trial and adoption of new offerings should be assessed in a comprehensive manner and not as individual sub-areas as has been done thus far. To this end formed research framework will serve as a basis to build on future research findings. A significant point deserving further research attention is to gather more evidence on links and potential overlaps between different factors of the research framework. With this information framework could be made more mutually exclusive and collectively exhaustive, which would improve its applicability in future researches. In addition, relative significances of factors in the research framework is a potential future research topic. Existing research implies most influential factors, but leaves other factors without a relative ranking.

In regard of systemic offerings and their trial and adoption, this research is not able to specify in a clear manner elements that differentiate them from other offerings. Observed links and interdependencies between research framework's factors is though an aspect that might be more relevant to them. As links and interdependencies have not been commented upon in other researches, future research is required to clarify whether observed links and interdependencies are a special trail relating to systemic offerings or whether it is a general attribute of offerings, which should always be considered, when assessing factors influencing their trial and adoption.

6. CONCLUSION

This research set out with three research objectives that were to form a framework, which summarizes our existing knowledge on this topic and enables a comprehensive assessment of different factors influencing the trial and adoption of new offerings; to confirm the legitimacy of this framework's contents with empirical evidence and to provide Case firm with an analysis on key factors influencing trial and adoption of its new offering and concrete recommendations on how to enable and further promote success of its new offering. In retro perspective it may be stated that these objectives were met to an acceptable degree.

Nonetheless, as the trial and adoption of new offerings is a complex topic and as this research represents first attempts to assess it in a comprehensive manner, some topics of the formed research framework require further research to improve its general applicability. In this respect the conducted research represents a basis, from which future researches may build on. Original aim of being able to specify factors influencing trial and adoption of systemic offerings that are technological in nature was not fully reached and this is why increasing our understanding on this topic should also be pursued further.

In regard of the new offering, around which this research has revolved, Case firm faces significant decisions to ensure its commercial viability. Comprehensive assessments on the new concept clarified perhaps for the first time overall situation. As assumption is that other firms would gain similar insights by conducting alike thorough analyses on their offerings, it is hoped for that this research's comprehensive approach for analyzing offering's attributes is applied more widely. Its strength is in enabling the discussion on all relevant factors that influence the trial and adoption of new offerings.

7. REFERENCES

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APPENDIX I – QUESTIONNAIRE, 1ST VERSION

INTERVIEW THEME 1: IMAGE BARRIER

- What is your perception of Case firm?
- Would you consider Case firm a trusted supplier in your business?
- Are Case firm's references on an acceptable level?

INTERVIEW THEME 2: COMPLEX PRODUCT OR SYSTEM OF THE CUSTOMER

- Quantity of systems, which can be considered separate?
- Technological newness of customer's system(s)?
- Quantity of subsystems and components?
- Quantity of supporting processes?
- Extent of embedded software in it?
- Degree of customization?
- How demanding for subsystems and components is the system?
- Critical areas, for example with dust or chemicals, in the system?
- Investment cost of the system(s)?

- Variance of inputs and outputs?
- Continuous- or batch-based production?
- Scale of the production?
- Utilization rate?

- In case something critical breaks, can production be replaced somehow?
- In case production ceases unplanned, which factors incur costs?

INTERVIEW THEME 3: CUSTOMER CHARACTERISTICS

- Breadth and depth of technological capabilities of the other party?
- Is this a new service concept to them?
- Customer's perceptions of the differences in technology?
- Customer's perceptions of the rate of change of the technology?
- Preferences of different participants to the buying process?

INTERVIEW THEME 4: USAGE BARRIER

- How does preventive maintenance at the moment work in your firm?
- Do you have on-going temperature or vibration measurement process in place?
- Have your maintenance personnel received training on preventive maintenance and its measures?
- Is preventive maintenance considered something valuable in your firm?
- Do standards or insurance policies require you to carry out certain preventive maintenance measures?

INTERVIEW THEME 5: TRADITION BARRIER

- What existing system is there in place to receive information on the process equipment?
- How large of an investment has been made to it?
- How extensive training has your personnel received on this system?
- Is it possible to change part of the system or the whole system?

INTERVIEW THEME 6: RISK BARRIER

- Do you find our service concept difficult to understand? (Complexity)
- Would you like to try out our service concept before the purchase decision? (Trialability?)
- Would you like to see demonstration of the measurement data Case firm is able to provide? (Observability?)

INTERVIEW THEME 7: VALUE BARRIER

- What is the relative advantage of Case firm's service concept...
    - ... compared to competitors?
    - ... compared to the existing maintenance system?
    - ... compared to the purchasing price of a new machine?

CONCLUSION OF CUSTOMER'S REASONING

- DESCRIBE FREELY

APPENDIX II – QUESTIONNAIRE, FINAL VERSION

INTERVIEW THEME 1: IMAGE BARRIER

- What is your perception of Case firm?
- Has Case firm supplied equipment or services to your business before?

INTERVIEW THEME 2: COMPLEX PRODUCT OR SYSTEM OF THE CUSTOMER

- Scale of the production?
- Utilization rate?
- Continuous- or batch-based production?
- Variance of inputs and outputs?

- Quantity of systems, which can be considered separate?
- Technological newness of customer's system(s)?
- Quantity of subsystems and components?
- Quantity of supporting processes?
- Extent of embedded software in it?
- Degree of customization?
- How demanding for subsystems and components is the system?
    - *Especially in regard of electrical motors*
- Investment cost of the systems?
    - *Critical systems + Electrical motors*

- Have you conducted a review of the critical machinery at this plant?
- Critical areas in the system?
    - *Critical machinery?*
    - *Dust?*
    - *Chemicals?*
- In case something critical breaks, can production be replaced somehow?
- In case production ceases unplanned, which factors incur costs?
    - *Quick logistics?*
    - *Lost production?*
    - *Fees?*
    - *Other factors?*

INTERVIEW THEME 3: USAGE BARRIER

- Size of the service organization?
- Breadth and depth of technological capabilities of the other party?
    - *In regard of maintenance operations they carry out themselves*

- How does preventive maintenance at the moment work in your firm?
- Have your maintenance personnel received training on preventive maintenance and its measures?
- Do standards or insurance policies require you to carry out certain preventive maintenance measures?
- Are preventive maintenance measures considered something valuable in your firm?
- As how reliable equipment do you perceive electrical motors?

- Do you have on-going temperature or vibration measurement process in place?
- Do you consider them beneficial to your operations?
- Customer's perceptions of the differences in technology?
- Customer's perceptions of the rate of change of the technology?

INTERVIEW THEME 4: TRADITION BARRIER

- Have you heard of a similar service concept before?
- What existing system is there in place to receive information on the process equipment?
- Have extensive investments been made to it?
- How extensive training has your personnel received on this system?
- Is it possible to change part of the system or the whole system?

INTERVIEW THEME 5: RISK BARRIER

- Do you find our service concept difficult to understand? (Complexity)
- Would you like to try out our service concept before the purchase decision? (Trialability?)
- Would you like to see demonstration of the measurement data Case firm is able to provide? (Observability?)

INTERVIEW THEME 6: VALUE BARRIER

- What is in your opinion the relative advantage of Case firm's service concept...
    - ... compared to competitors?
    - ... compared to the existing maintenance system?
    - ... compared to the purchasing price of a new machine?

- What is the biggest defect in our service concept at the moment?

CONCLUSION OF CUSTOMER'S REASONING

- DESCRIBE FREELY

APPENDIX III – DETAILS OF CONDUCTED INTERVIEWS

Table 21. Overview on conducted customer interviews

Reference	Interview date	Industry	Questionnaire type	Interview type	Detailed notes	Recording
Customer interview 1	16.3.	A	Piloting 1st version	Face-to-face	X	
Customer interview 2	17.3.	A	Piloting 1st version	Face-to-face	X	
Customer interview 3	17.3.	A	Piloting 1st version	Face-to-face, 2 customer's representatives	X	
Customer interview 4	29.3.	A	Piloting 1st version	Face-to-face	X	
Customer interview 5	29.3.	A	Piloting 1st version	Face-to-face	X	
Customer interview 6	20.4.	C	1st version	Face-to-face, 2 customer's representatives	X	
Customer interview 7	28.4.	B	1st version	Face-to-face, 4 customer's representatives	X	
Customer interview 8	28.4.	B	1st version	Face-to-face	X	
Customer interview 9	6.5.	B	1st version	Face-to-face	X	X
Customer interview 10	11.5.	B	1st version	Face-to-face	X	
Customer interview 11	11.5.	B	1st version	Face-to-face	X	
Customer interview 12	18.5.	B	Final version	Face-to-face	X	X
Customer interview 13	18.5.	B	Final version	Face-to-face, 3 customer's representatives	X	X
Customer interview 14	19.5.	B	Final version	Face-to-face	X	X

Customer interview 15	31.5.	B	Final version	Face-to-face, 3 customer's representatives	X	X
Customer interview 16	1.6.	B	Final version	Face-to-face, 2 customer's representatives	X	X
Customer interview 17	1.6.	B	Final version	Face-to-face	X	X
Customer interview 18	8.6.	B	Final version	Face-to-face, 4 customer's representatives	X	X
Customer interview 19	8.6.	A	Final version	Face-to-face	X	
Customer interview 20a	9.6.	B	Final version	Face-to-face, representatives of 2 units in the same interview	X	
Customer interview 20b	9.6.	B	Final version	Face-to-face, representatives of 2 units in the same interview	X	
Customer interview 21	9.6.	B	Final version	Face-to-face	X	X
Customer interview 22	14.6.	B	Final version	Face-to-face	X	X
Customer interview 23	14.6.	D	Final version	Face-to-face, 2 customer's representatives	X	X
Customer interview 24	30.6.	C	Final version	Phone interview	X	

Table 22. Overview on conducted interviews within Case firm

Reference	Interview date	Main themes	Interview type
Case firm's technical expert	29.7.	Existing condition monitoring solutions and cost comparisons of the new concept	Phone interview
Case firm's senior sales manager	11.8.	Initial research findings and their implications to launch decisions	Face-to-face
Workshop	25.8.	Changes to launch decisions and specific measures to promote trial and adoption of the new concept	Face-to-face, 3 people present in the workshop